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The Convergence of Health Care Financing Structures: Empirical Evidence from OECD-Countries

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Abstract

In this paper we concentrate on the question whether the financing structure of the health care systems converges. In a world of increasing economic integration convergence in health care financing (HCF) and, hence, decreasing differences in HCF across countries enhance individuals' (labour) mobility and support harmonization processes. As an indicator for convergence we take the public financing ratio in % of total HCF and in % of GDP. The major finding is that HCF in the OECD countries converged in the time period 1970 – 2005. This conlusion also holds when looking at smaller sub groups of countries and shorter time periods. However, we find evidence that countries do not move towards a common mean and that the rate of convergence is decreasing over time.

Keywords: Convergence, health care system, health care financing.

JEL classification: I11, I18, H55

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1 Introduction

For many years the 'nation states'[1] were able to establish and conserve fairly idiosyncratic institutional designs and policy cultures in the health care sector. In the last two decades, the co-occurrence of socio-demographic, economic and institutional changes has reduced the capacity of the nation states for an autonomous health care policy, leading to a convergence in the health care systems.

In contrast to previous literature which mainly examines the expenditure side of the health care system we focus on the financing side and its inherent collection of revenues. Our research question deals with to the convergence/divergence in financing structures – defined as the public-private financing mix – in the health care systems in the OECD-countries. Using the concepts of σ-convergence (measured as coefficient of variation) and absolute and conditional β-convergence we analyse whether (private-public) financing converged or diverged in the time period 1970-2005. Hence, besides our analysis of the hitherto neglected financing side we contribute to the existing literature by focusing on a long-run perspective (36 years) and a broad sample of 23 countries. The data enable us to examine convergence patterns for different sub samples (with respect to their health care system) and time periods.

Our results indicate that the health financing structure converged in this time period. In particular, the country effects included (country specific characteristics and country dummies) indicate that states do not move toward a common mean. We also find evidence that the rate of convergence decreases over time. These results are robust with regard to different specifications of the dependent variable, to different methods of testing for convergence, to different assignments of countries to sub samples, and to the time frame chosen.

The structure of the paper is as follows. Section 2 provides a brief discussion of previous literature on convergence in the health care sector. In section 3 we present the methodological framework, indicators, and data used in the paper. Section 4 presents the empirical results. Con-

[1] When we use the term 'nation state' we just use it as a borderline to other states. We are aware of the fact that the internal potential of the 'nation state' to steer the health care sector is quite limited. For a very illustrative discussion of this topic see Immergut (1990).

cluding remarks and suggestions for future research are offered in the last section.

2 Previous Research

Our research question falls into the broader range of studies which focus on the convergence in health care systems. Overall, this literature reveals a rather heterogeneous picture. Several authors identify a trend toward convergence (Nixon 2000, Hitiris & Nixon 2001), others find no signs for convergence at all (Globerman & Vining 1998, Montero-Granados, De Dios Jimenez & Martin 2007), while the third strand of authors draws a mixed picture (Saltman 1997, Wendt, Grimmeisen & Rothgang 2005), finding convergence for some and divergence for other indicators. To some extent, this heterogeneity arises from methodological differences in the study designs. In this respect we have to separate at least the following different approaches.

(i) Based on the unit of analysis we can separate between intra-state studies and international comparisons of health care systems, the latter being far more frequent. There exist two recent intra-state studies: Wang (2009) examines convergence in real per capita health expenditures in the 50 US states over the period 1980-2004 and Montero-Granados et al. (2007) analyze the convergence/divergence in the health status in Spain on a provincial and regional level.

(ii) Depending on the indicator of convergence studies can be classified into multidimensional and single-dimensional studies. Within the former a three-dimensional concept of the health care system dominates. It includes the dimensions financing, regulation and service provision (see for example Wendt et al. 2005). This structure allows the authors to analyse simultaneously the financing mix, the provision mix and the extent of state regulation in financing and provision and therefore enables statements on the overall convergence in the health care systems. So far, studies of this type have been characterized by (very) small sample sizes (see for example Aldridge & Sundarapandiyan 1995, Globerman & Vining 1998, Globerman, Hodges & Vining 2001). The majority of the studies on convergence are single-dimensional thereby preferring health expenditures – either per capita or as a ratio to GDP, as a whole or split into its major components (public vs. private, inpatient vs. outpatient) – as indicators of convergence/divergence (Comas-Herrera 1999, Nixon 1999, Nixon 2000, Hitiris & Nixon 2001, Dreger & Reimers 2005, Kerem, Puss & Maldre 2008).[2] Studies on convergence in the financing structure (e. g. private vs. public) of the health care sector are missing.[3]

(iii) The methods applied for testing convergence allow for a third classification of previous literature. The first type of studies is heavily influenced by the convergence hypothesis derived from the neoclassical growth theory and uses the concepts of σ-convergence and absolute and conditional β-convergence. Initially, this concept was based on cross-section data, in recent studies this approach was also applied to panel data sets and methods (Nixon 2000, Hitiris & Nixon 2001, Sanz & Velázquez 2004, Kerem et al. 2008). The second strand of literature is based on time series analyses.[4] These studies define convergence as transitory deviations from identical long-run trends, either deterministic or stochastic. Several empirical studies follow this approach highlighting different aspects of the convergence topic (Comas-Herrera 1999, Narayan 2007, Narayan & Narayan 2008, Wang 2009). A third strand of literature analyses convergence implicitly by using different methodological approaches. For example, Alcalde-Unzu, Ezcurra & Pascual (2009) present a factor decomposition of the differences in health expenditure growth. Okunade & Suraratdecha (2006) examine the inertia of pharmaceutical expenditures. Clemente, Marcuello, Montañes & Pueyo (2004) focus on the differences in the expenditure functions of the private and public health care sector.

(iv) Last but not least, insights into the convergence hypothesis in the health care system can also be gained from studies which focus on the broader perspective of convergence in the welfare state. It is the merit of

[2]Some studies focus on the outcome indicator health status. For example, Mayer-Foulkes (2001) asks whether there are convergence clubs in cross country life expectancy dynamics.

[3]Due to the financing-expenditure link the split into public and private expenditures also offers insights into the public-private financing structure.

[4]For the discussion of testing convergence using cross-section or time series data and methods see Bernard & Durlauf (1994). For the closely related problem of stationarity of health care expenditures and their determinants see for example Hansen & King (1996), McCoskey & Selden (1998), Gerdtham & Löthgren (2000), Okunade & Karakus (2001), MacDonald & Hopkins (2002), Dreger & Reimers (2005).

these studies to stress the importance of the institutional design of the welfare state for the impact of internal and international changes and shocks for convergence/divergence (see Pierson 2000, Wolf 2002, Corrado, Londoño B., Mennini & Trovato 2003, Kim & Zurlo 2008). This aspect is crucial as the convergence studies – especially those which use time series methods – are to a high extent a-institutional. One therefore is tempted to conclude that the inexorable nature of health expenditure (financing) is beyond the reach of policy.

3 Empirical framework

3.1 Motivation

Within the health care system health care financing (HCF) fulfills different functions (Busse, Schreyögg & Gericke 2007): (i) Collecting revenues, (ii) pooling revenues (risks) and (iii) purchasing services. These three tasks can be unified in one organisational entity or can be split up between different institutions.

The collecting stage is important for several reasons: (i) Public and private financing may have different effects on equity of financing, health care utilization and health status (see Wagstaff & van Doorslaer 2000, van Doorslaer, Koolman & Jones 2004). (ii) Different degrees of risk pooling and risk reduction are associated with this dichotomy. While out-of-pocket (OOP) payments do not include risk pooling at all and private health insurance only reduces the health expenditure risks, public financing via taxes or income-based contributions also includes some element of reducing the income risk. Hence, the risk spectrum covered by public financing is broader compared to private financing. (iii) In a normative perspective specific forms of collecting (e. g. public insurance) are able to reduce market failures in the coverage of health care risks (for a detailed discussion see Hurley 2000). (iv) Finally, there exists a link between the financing structure and the efficiency in the provision of health care services (see Propper & Green 1999, Globerman & Vining 1998, Glied 2008*a*, Glied 2008*b*). This link includes much more than the well known moral hazard phenomenon.

Why should one study the convergence of the collecting stage? Even without stressing the convergence issue its economic significance mentioned above turns this stage of financing into a rewarding object of economic analysis.

In a world of increasing economic integration the similarity of health care financing between countries is worth investigating on its own. The convergence across countries enhances the mobility in the labour market and cross border shopping within the health care sector. Furthermore, convergence in HCF reduces the incentive and benefit to follow the outside option. By studying the (conditional) convergence we additionally learn about the determinants of the public-private share. Understanding the patterns and drivers of the adaption processes could help to answer questions such as what future financing systems will look like and whether there exists something like a 'best response' to the financing challenge.

3.2 Dependent variables

Our dependent variables refer to the public-private dimension of financing.Basically, public funding means that there exists a degree of transfer between the individual contribution and the coverage offered. Therefore, the collecting institutions are endowed with coercive power (for details see OECD 2000). Public HCF is based on two sources: (i) general taxation and (ii) contributions to social health insurance. Private financing includes (i) contributions to private health insurance[5] and (ii) direct financing by private households such as OOP-spending for services and different types of cost-sharing.

To examine convergence in public-private HCF we use two different dependent variables. The first indicator refers to public financing in % of total HCF (*public*), the second variable represents public financing in % of GDP (*publicgdp*).

[5]Private health insurance can offer primary, duplicate, complementary and supplementary coverage. For a detailed discussion of these different functions see OECD (2004).

3.3 Explanatory variables

The public-private-ratios are not only an instrument of health care policy but they also picture the private behaviour in the health care sector including the private reactions to changes in the health care policy. Consequently, we have to use a perspective which is able to explain the joint allocation of resources to the public and private sectors of the health care system. Gouveia (1996) offers such an approach. According to the author's results private and public expenditures are determined by the distribution of individual characteristics (e. g. morbidity risk distribution, income) and institutional features (financing structure in the public sector, decision rule in the public sector, shape of private insurance contracts, etc.). Which implications can be drawn for the convergence in HCF from this perspective?

We expect that the public ratio of financing is the same for different countries only if the distribution of individual characteristics and preferences and the institutional features are the same across all countries. Only in this extreme case the steady state in the financing ratio is expected to be the same for all countries. If, under these assumptions, differences in the financing ratio are observable these can only result from institutional rigidities or path dependences after previous shocks. If the institutional design of the financing system differs between the countries similar changes in the individual characteristics may have different effects on the financing ratio. The variations in these effects are intensified if cross country differences in the financing systems as well as individual characteristics coincide. In a nutshell, this may lead to convergence clubs and not to a general convergence (Kim & Zurlo 2008). In summarizing these arguments we conclude that the concept of conditional β-convergence seems to be a more appropriate approach. We take these considerations into account by controlling for the following characteristics:

- Public health insurance coverage (*publiccov*): We expect a positive relationship between the proportion of the population with public health insurance coverage and the public ratio in financing. The increase of this proportion includes a crowding out effect of private financing, especially when the two insurance opportunities are substitutes. In addition, at least in health care systems of the social health insurance (SHI) type, public health insurance coverage broadens the basis of public financing.

- Demographic burden (*elderly*): All health care systems face an increasing burden due to the increase of life expectancy and the shifting in the proportion of the different generations. The effect of changes in the demographic burden on the public financing ratio depends on the institutional design of the health care system. We expect that an increasing number of elderly people positively influences the public financing ratio, as a rising demographic burden intensifies the need for intergenerational redistribution. Intergenerational redistribution is more likely to be assured by public financing. We control for these effects by including a variable capturing the proportion of a country's population older than 65 years.

- Openness of the economy (*openc*): We address the impact of an increasing openness of the economy and, hence, increasing economic interdependence on the convergence in the public financing ratio. In this context there are two different strands of arguments in favour of convergence in HCF but at different levels. On the one hand the 'compensation hypothesis' claims that the emerging internationalization of economies leads to an increasing demand for public assistance to cover social risks (Kim & Zurlo 2008). On the other hand the 'race to the bottom hypothesis' claims a downsizing of the public institutions for social assistance to their efficient level or even to a level below the efficient one (Wolf 2002). In the present study we use total trade (sum of exports and imports in national currencies) in % of GDP[6] as an indicator for economic openness to examine whether such influences lead to convergence.

- Political orientation of the government (*govleft*): To some extent, the financing ratio is fixed in a political decision process and therefore reflects the preferences of the political agents on public and

[6]This value does not change when export, import and GDP are expressed in real values as the price level for these figures is the same (see http://pwt.econ.upenn.edu/Documentation/append61.pdf, page 10).

private HCF. We assume that left oriented governments favour public HCF over private HCF. We include cabinet posts held by left parties in percentage of total cabinet posts as an indicator for the governments' political orientation.

- Income ($\ln gdpcap$) as a driver of health care expenditures: Empirical literature on the health expenditure/GDP-relationship widely agrees that GDP per capita is one of the major drivers of health care expenditures (see e. g. Okunade & Murthy 2002). This is not only true for the overall health care expenditures but also for the two components private and public financing. But as Gouveia (1996) and Clemente et al. (2004) demonstrate, the effect of differences in the level and growth of GDP per capita on the two components might be different, depending on the institutional design of the public and private financing scheme. In addition to this, preferences for different forms of risk coverage might change when income rises. If we assume that the variety of health care packages is a superior good we would expect that an increase in GDP will strengthen the private health care provision (financing). On the other hand, the coverage of health care risks could be interpreted as a superior good and public coverage is an important – in some situations preferable – option of protection. Consequently, we are not able to conclude that the convergence in GDP per capita automatically leads to a convergence in the financing ratio. Information on income is included in the form of logarithmic GDP per capita (in US$ purchasing power parity).

- Type of the health care system (*NHS*): As already highlighted, the institutional design of the health care system acts as a 'filter' which transforms external changes/shocks in the economic and demographic surroundings into decisions and outcomes. The term 'institutional design' captures more than just budget constraints and financing schedules in a narrow economic sense (e. g. 'culture' of decision making and conflict resolution). We control for these potential differences by separating the sample into three different country groups: countries which provide national health services (NHS), countries with social health insurance (SHI), and others.

- Country and time effects: Country and time dummies are included in the regression analysis to control for (i) overall country-specific characteristics thereby also controlling for differences in the countries' health care systems and (ii) time trends which cannot be addressed specifically.

3.3.1 Data sources and sample design

Data employed for the analyses in the present paper are taken from two data sources. Information regarding HCF (*public, publicgdp, publiccov, gdpcap, elderly*) stems from the OECD health statistic database. This source originally includes information on 30 countries with a time coverage starting in the year 1960. Data referring to political variables are available from the comparative political data set collected by the University of Bern.[7] It reports political and institutional data on an annual basis for 23 OECD countries for the period 1960 to 2005. Out of this comprehensive set we use information on the openness of the economy (*openc*) and the government's political orientation (*govleft*). Our final data cover a period of 36 years (1970-2005) for which most of the relevant variables are available. The remaining few gaps were completed by inter- or extrapolation.

3.4 Econometric specifications

To test convergence in HCF we apply the concepts of σ-convergence as well as absolute and conditional β-convergence.[8] In particular, we examine the convergence in public financing in % of total HCF (*public*) and public financing in % of GDP (*publicgdp*) towards their respective steady state level using cross section and panel data analyses. We start with analysing σ-convergence pictured by the coefficient of variation (CV) and its development over time. It is calculated from cross section information by dividing a variable's standard deviation σ by its mean μ where σ and

[7] http://www.ipw.unibe.ch/content/team/klaus_armingeon/comparative_political_data_sets/

[8] The latter concepts were developed within the framework of neoclassical growth models to explain the convergence in aggregate output (see for example Barro & Sala-i Martin (1992) for convergence in income per capita) and assume the existence of a steady state in economic development.

μ are averaged over countries:

$$CV_t = \frac{\sigma_t}{\mu_t} \tag{1}$$

The concept of β-convergence is the second convergence measure applied. In these regression analyses the focus is on examining whether a series moves toward its mean over time. Barro & Sala-i Martin (1992) show that the average growth rate (based on the neoclassical growth model) of y over a time period between 0 and T is

$$\frac{1}{T}\ln\left(\frac{y_T}{y_0}\right) = x + \frac{1-e^{-bT}}{T}\ln\left(\frac{y^*}{y_0}\right) \tag{2}$$

where x denotes the steady state growth rate and y^* represents the steady state of y. The base equation, we estimate in this paper, is a reformulation of equation (2) and reads as

$$\frac{1}{T}\ln y_{iT} = \alpha_i + \beta \ln y_{i0} + \epsilon_i \tag{3}$$

where y stands either for *public* or *publicgdp*, $\alpha_i = x_i + \frac{1-e^{-bT}}{T}\ln y_i^*$, β pictures the convergence coefficient and consists of $\frac{e^{-bT}}{T}$ and ϵ refers to the error term. T indicates for how many years data are available, the index 0 describes the initial period. i stands for country as the cross sectional unit. Equation (3) examines convergence in the cross section. If $\alpha_i = \alpha$, i.e. the same for all countries, and $\beta < 1$, this implies that countries unconditionally move toward a uniform steady state.[9]

In order to analyse convergence based on panel data we use an extension of equation (3) which applies for discrete periods:

$$\ln y_{it} = \alpha_i + \beta_1 \ln y_{it-1} + \gamma z_{it} + \eta_t + \epsilon_{it} \tag{4}$$

with $\alpha_i = x_i + (1-e^{-bT})\ln y_i^*$ and $\beta = e^{-b}$. y again represents the dependent variables *public* and *publicgdp*, respectively. The parameter α_i

[9]Note, that our dependent variable refer to its quantity in period t (instead of its growth). If we subtracted 1 from the parameter β we would get the corresponding coefficient if the growth rate were the dependent variable. The speed of convergence b can be calculated from the regression coefficient β on the initial level y_0. For example, for the specification at hand, $b = -\frac{ln(T\beta)}{T}$.

introduces a shift which may be different for each country, i. e. it allows for a movement toward country specific means. Beside this 'general' country dummies, the lagged dependent variable y_0 and time fixed effects η_t we include specific country characteristics as further explanatory variables z as discussed in Section 3.3.[10] ϵ_{it} is the disturbance term.

Before analysing convergence in *public* and *publicgdp* using panel data we test for stationarity of the variables included. We apply the unit root test developed by Levin, Lin & Chu (2002). For both dependent variables, $\ln public$ and $\ln publicgdp$, as well as the regressors we include a constant and one lag of the corresponding variable in the regression. We can reject the null hypothesis of non-stationarity for both dependent variables and the majority of independent variables at the 5 % significance level. Non-stationary variables are logarithmic GDP per capita ($\ln gdpcap$) as well as a nation's proportion of elderly people (*elderly*). Hence, we include their first differences (depicted by Δ) at the RHS so that all regressors are consequently stationary. Equation (4) (as well as (3)) implies that the convergence parameter β and, hence, the speed of convergence b does not vary across countries. We relax this assumption and test for potential differences in convergence patterns by running separate regressions for particular subgroups classified through (i) a country's health care system and (ii) specific time periods. For convergence to occur, β has to be significantly lower than one.[11]

In the sensitivity analysis we interact β with country dummies. The interaction of the convergence coefficient with country dummies enables us not only to control for different steady state levels across countries (captured by the country dummies) but also to examine whether the countries' rates of convergence differ statistically from each other (different slope parameters).

[10] One may doubt the exogeneity of the explanatory variables included. Although public HCF may shape the regressors used such influences do not occur contemporaneously. Rather, it is adequate to assume that the effects of public HCF on the regressors occur with some time lags meaning that today's HCF influences tomorrow's insurance coverage, proportion of elderly, GDP, ... but not today's levels.

[11] If $\beta = 1$, the series follows a random walk.

4 Results

4.1 Descriptive statistics

Table 1 reports descriptive statistics of the variables included in the final data set.

Table 1: Descriptive Statistics

Variable	Obs.	Mean	Std.Dev.	Min.	Max.
Dependent variable					
Public financing$^{a)}$	828	74.76	12.32	36.30	98.30
Public financing$^{b)}$	828	5.51	1.36	1.48	8.95
Independent variables					
Public health insurance coverage$^{c)}$	809	94.46	14.07	22.00	100.00
Population $> 65^{c)}$	828	13.34	2.46	7.10	20.20
Total trade$^{b)}$	805	68.31	42.27	11.25	288.74
Cabinet posts of left parties$^{d)}$	828	33.91	37.86	0.00	100.00
GDP per capita$^{e)}$	803	16.35	9.49	1.91	53.55

Notes: $^{a)}$ in % of total HCF, $^{b)}$ in % of GDP, $^{c)}$ in % of total population, $^{d)}$ in % of total posts, $^{e)}$ in thousand US $ PPP.

On average, public financing in % of total HCF (*public*) accounts for three-quarter of HCF. Public financing in % of GDP (*publicgdp*) amounts to 5.5 % on average. The mean of public health insurance coverage indicates that a high proportion – 94 % – has public health coverage. 13.3 % of the countries' population is older than 65. The economic indicators show an average GDP per capita of about 16,000 US$ and a trade volume of 68 % of GDP. Social democrats and other left parties on average hold about one third of the available cabinet posts.

Figure A1 in the Appendix depicts the average share of public financing for the total sample as well as for two sub groups. The sub groups consist of 14 countries which run a National Health Service (NHS) and 7 countries characterized by Social Health Insurance (SHI).[12] Public financing considering the total sample starts at a value of 72.1 % in 1970

[12] NHS countries are Australia, Denmark, Finland, Greece, Ireland, Iceland, Italy, Canada, New Zealand, Norway, Portugal, Sweden, Spain and United Kingdom. Austria, Belgium, Germany, France, Japan, Luxembourg and the Netherlands represent the group of SHI countries. Switzerland and the United States together form the group 'Others' as they can neither be classified as NHS nor as SHI countries.

and ends with an average of 74.6 % in 2005. The minimum (maximum) appears in 1971 (1979) and amounts to 71.6 % (77.5 %). The series reveals similar patterns for NHS and SHI countries with a minimum of 73.3 % in 1971 and a peak at 80.6 % in 1979 in the NHS group and corresponding values of 74.1 % in 1971 and 80.9 % in 1993 for the SHI countries.[13]

The temporal development of public financing in % of GDP (*publicgdp*) is shown in Figure A2. The initial values are around 3.8 % for the total sample (which again includes Switzerland and the USA) as well as for the NHS and SHI group, respectively. *publicgdp* increases over the years and ranges between 6.8 % (NHS countries) and 7.5 % (SHI countries) in the year 2005.

Figures A3 and A4 in the Appendix provide a first answer to the question whether convergence is observable regarding the level of *public* and *publicgdp* (β-convergence). Figure A3 (Figure A4) depict the countries' average annual growth rate of *public* (*publicgdp*) in % on the y-axis and its initial value on the x-axis. The data points indicate a negative relationship between growth and initial level. In other words, countries with initially low levels of *public* and *publicgdp*, respectively, grow faster than countries with high initial values implying that the countries finally converge to each other.

4.2 Empirical Estimates

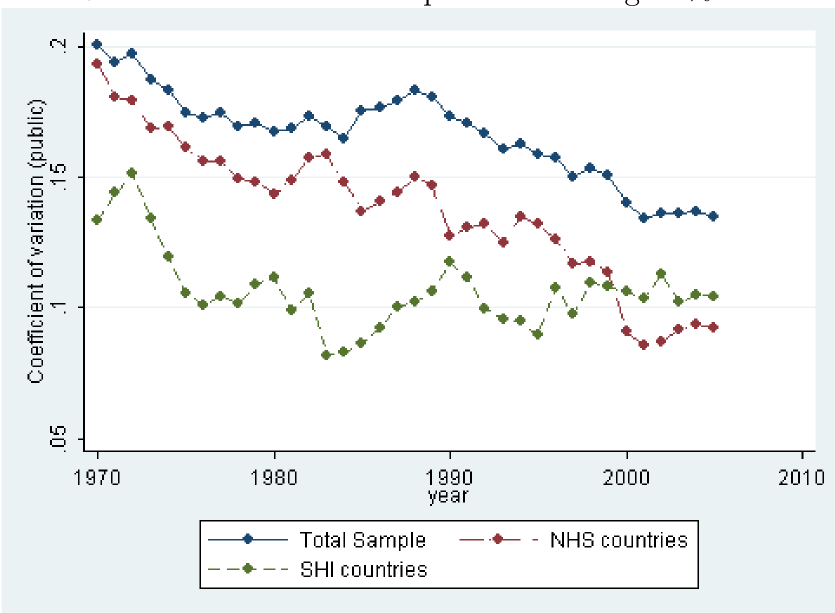
This section presents the outcome of the analysis described in Section 3.4. We examine σ-convergence (measured as CV according to equation (1)) for the total sample and for the NHS and SHI sub samples using *public* and *publicgdp*. Figures 1 and 2 graphically picture the trend of the CV.[14] Table 2 presents the annual average growth in σ-convergence for both series and different time periods.

[13] In order to improve clarity we forgo plotting *public* for the third group, consisting of Switzerland and the United States. The corresponding values are significantly lower at each point in time. The minimum (maximum) is 44.9 % (55.2 %) in 1988 (1983). The line in Figure A1 referring to the total sample includes these values. This explains why the curve picturing the total sample always runs below the curves for the two other sub samples.

[14] As before, we do not plot the values for Switzerland and the USA for clarity reasons but their values are included in the plot representing the total sample.

For the total sample, the CV decreases from 0.200 to 0.135 (Figure 1) and from 0.315 to 0.116 (Figure 2), respectively. The annual average growth in σ-convergence amounts to 1.1 % for *public* and to 2.7 % in case of *publicgdp*. However, the relative dispersion differs across time periods. While the CV in the periods 1970-1979 and 1990-2005 is quite similar within the series, the figures indicate no convergence for *public* during the years 1980-1989 and a dampened divergence pattern for *publicgdp*. All in all, these results confirm that the public HCF has converged in the period 1970-2005 and that convergence is more pronounced for *publicgdp* than for *public*.

Figure 1: Coefficient of variation – public financing in % of total HCF



Distinguishing between NHS and SHI countries we find that with respect to *public* the CV is considerably higher for NHS than for SHI countries in the year 1970 (0.193 vs. 0.133) but the two CV approach each other over time. In 2005, the CV amounts to 0.092 (NHS) and 0.104 (SHI), respectively (see Figure 1). This trend is pictured in the negative annual average growth in σ-convergence, indicating a more distinctive convergence pattern for NHS than for SHI countries (see column (3) in Table 2). In the NHS sub sample convergence mainly arise in the periods 1970-1979 and 1990-2005 while dispersion during 1980-1989 – and for SHI countries in 1990-2005 – is very moderate.

Figure 2: Coefficient of variation – public financing in % of GDP

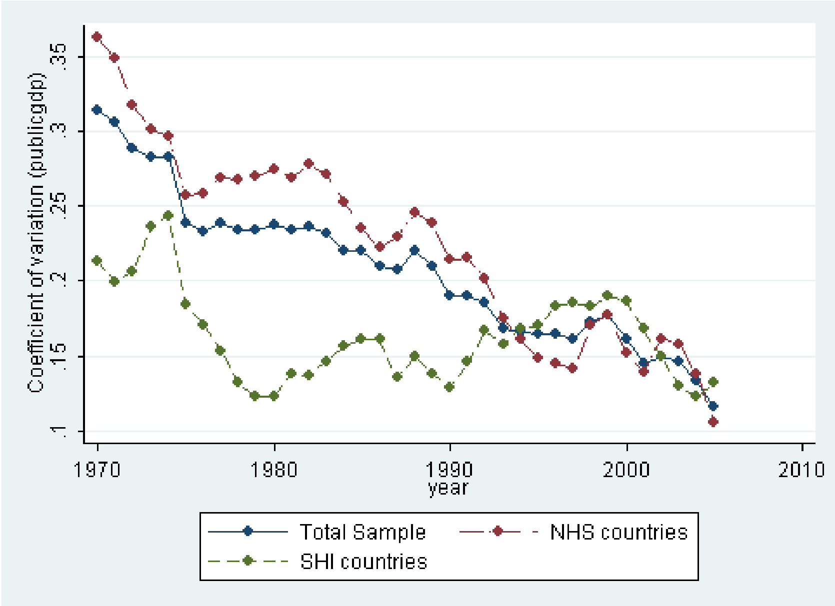


Table 2: Annual average growth in σ-convergence

	Public financing					
	in % of total HCF			**in % of GDP**		
	(1)	(2)	(3)	(4)	(5)	(6)
Period	All	NHS	SHI	All	NHS	SHI
1970-2005	−1.08%	−1.93%	−0.33%	−2.67%	−3.12%	−0.91%
1970-1979	−1.73%	−2.89%	−1.94%	−3.08%	−3.10%	−5.34%
1980-1989	0.58%	0.00%	0.28%	−1.07%	−1.12%	1.52%
1990-2005	−1.76%	−2.60%	0.21%	−3.45%	−4.38%	0.05%

Notes: σ-convergence refers to the coefficient of variation.

Similar patterns – different CV for NHS and SHI countries in the initial period which approach over the years – are observable with respect to *publicgdp* (Figure 2). For NHS (SHI) countries, CV falls from 0.363 (0.213) in 1970 to 0.106 (0.132) in 2005 which indicates a higher convergence pattern for NHS than for SHI countries (see columns (5) and (6) in Table 2). While for NHS countries the relative dispersion is largest in the periods 1970-1979 (change of 3.1 %) and 1990-2005 (4.4 % change), for

SHI countries convergence mainly occurs during the initial years where the annual average change in σ-convergence amounts to 5.3 %.

To summarize our results with respect to σ-convergence: For both series, *public* and *publicgdp*, we observe declining patterns (although not monotonically declining) in CV which indicate that the variation across countries decreases over time. However, convergence patterns differ between different time periods and health care systems: While convergence is strongly influenced by the tendencies in the periods 1970-1979 and 1990-1995, relative dispersion is moderate within the years 1980-1989. Furthermore, convergence patterns are more pronounced within NHS than SHI countries.

Our first set of regression estimates refers to the concept of absolute convergence using cross section data. Due to the small sample size at this level we desist from running separate calculations for each sub sample and from investigating conditional convergence. However, for both of our dependent variables (log values), $\ln public$ and $\ln publicgdp$, we conduct regressions for the whole time span 1970-2005 as well as for smaller time segments to test whether the coefficients on the initial values vary among time. The estimates given in column (1) in Tables 3 and 4 cover 36 years, columns (2), (3), (4) refer to the periods 1970-1979, 1980-1989 and 1990-2005, respectively. Except for $\ln publicgdp$ referring to the whole period the coefficients associated with the initial values of each time period always reveal a significant impact. The coefficients describe that the lower a country's initial share of public financing – measured via public financing in % of total HCF or in % of GDP – is the more pronounced the corresponding growth. This means that countries with low initial values catch up in terms of public financing.

The following estimates take advantage of the panel structure of the data and are based on the least square dummy variable (LSDV) estimator. This enables us to control for country and time effects by including country and time dummies. In addition to the lagged dependent variable, the country and time dummies we introduce further explanatory variables to examine whether specific differences across countries induce a movement to a country's own steady state which is known as conditional convergence (see equation (4)). We conduct separate regressions for the NHS and SHI countries as well as for three different time peri-

Table 3: Absolute β convergence in $\ln public$ - cross section analysis

Variable	(1) 1970-2005	(2) 1970-1979	(3) 1980-1989	(4) 1990-2005
lnpublic70	0.015***	0.080***		
	(0.003)	(0.007)		
lnpublic80			0.100***	
			(0.006)	
lnpublic90				0.042***
				(0.005)
Obs.	23	23	23	23
Adj. R^2	0.65	0.89	0.84	0.81

Notes: Constant not reported. Robust standard errors in parenthesis. *** indicate the 1% level of significance.

Table 4: Absolute β convergence in $\ln publicgdp$ - cross section analysis

Variable	(1) 1970-2005	(2) 1970-1979	(3) 1980-1989	(4) 1990-2005
lnpublicgdp70	0.003	0.062***		
	(0.002)	(0.007)		
lnpublicgdp80			0.074***	
			(0.012)	
lnpublicgdp90				0.021***
				(0.006)
Obs	23	23	23	23
Adj. R^2	0.06	0.75	0.63	0.32

Notes: Constant not reported. Robust standard errors in parenthesis. *** indicate the 1% level of significance.

ods, 1970-1979, 1980-1989 and 1990-2005, respectively. Table 5 shows the results for $\ln public$, Table 6 presents the estimates for $\ln publicgdp$.

For both specifications, the coefficients on the lagged dependent variables are always significantly (at a 1 % significance level) smaller than 1 implying that countries with low initial public financing move faster towards their respective steady state. The estimates in Table 5 indicate that convergence between the countries in the total sample as well as the NHS and SHI countries occurs (columns 1-3). The hypothesis that β_1

(the coefficient on the lagged dependent variable) is equal between the NHS and SHI countries cannot be rejected. For the total sample as well as the subgroups of NHS and SHI countries the F-test indicates no significant difference meaning that within these groups there is convergence towards the same level of public financing. The country dummies given in columns 4-6 of Table 5 depict that country specific differences also play a role over time. These estimates additionally reveal that the rate of convergence[15] decreases over time as it is expected.[16] The explanatory variables included indicate that a country's public health insurance coverage *publiccov*, the openness of its economy *openc* and the governmental political orientation $govleft$ may induce a movement towards a country specific mean.

Regarding public financing in % of GDP $\ln publicgdp$ the country dummies are jointly significant in each sub group and time period (except for 1980-1989) but the H0-hypothesis that the rate of convergence is equal for the NHS and SI countries cannot be rejected (see Table 6). The explanatory variables included provide evidence that the change in a country's demographic burden $\Delta elderly$, the openness of an economy *openc* and the change in GDP $\Delta \ln gdpcap$ are major characteristics which promote country specific means. As before, the temporal split shows that the rate of convergence (comprised in $\ln publicgdp_{t-1}$) decreases over time.

The results given in the Tables 5 and 6 are in line with the findings of the graphical and cross section analyses as they indicate convergence in public financing in % of total HCF and public financing in % of GDP, respectively.

4.2.1 Robustness analysis

Nerlove (1971) and Nickell (1981) point at the bias of the fixed effects estimator when the lagged dependent variable is included in the RHS of the equation. However, this dynamic panel bias is declining with an increasing number of time periods. Analogous to our estimates shown in Tables 5 and 6 we calculate bias corrected LSDV estimators as suggested by Kiviet (1995) to check the robustness of our results (see Tables A1

[15]For the panel specification, the rate of convergence is given by $b_1 = -(\ln \beta)$.

[16]This pattern still holds when we keep the number of observations constant.

Table 5: Conditional β convergence in $\ln public$ - panel data

Variable	(1) All	(2) NHS	(3) SHI	(4) 1970-1979	(5) 1980-1989	(6) 1990-2005
$\ln public_{t-1}$	0.846***	0.828***	0.832***	0.412***	0.663***	0.795***
	(0.030)	(0.043)	(0.046)	(0.107)	(0.099)	(0.065)
$publiccov$	−0.000	−0.000	0.000	0.001	−0.000	−0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.003)
$\Delta elderly$	0.011	0.011	0.019	−0.016	0.017	0.010
	(0.008)	(0.010)	(0.013)	(0.042)	(0.014)	(0.008)
$openc$	−0.000	0.000	−0.001**	−0.001	−0.001	−0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
$govleft$	0.000*	0.000**	−0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Delta \ln gdpcap$	0.007	0.051	−0.101	−0.084	0.045	0.046
	(0.054)	(0.067)	(0.085)	(0.153)	(0.129)	(0.059)
Obs.	740	476	213	189	213	338
Adj. R^2	0.97	0.96	0.93	0.96	0.96	0.98
F-tests						
Country effects	1.38	1.50	1.51	2.63***	1.69**	1.53*
Time effects	1.26	1.16	0.74	3.10***	1.19	1.63*
$\beta_1 = 1$	26.32***	16.34***	13.43***	30.06***	11.63***	9.76***
χ^2*-test*						
Equal β_1		0.01				

Notes: Constant, country and time effects not reported. Robust standard errors in parenthesis. *, ** and *** indicate the 10%, 5% and 1% level of significance.

and A2 in the Appendix). Particularly for the estimates including all observations these corrected estimates do not considerably diverge from our previous estimates due to the broad time coverage (36 years) of the data applied. However, for the shorter time periods the Kiviet estimates demonstrate that the bias becomes more pronounced with decreasing time coverage. Regarding the declining tendency of the rate of convergence over time LSDV estimates and the Kiviet correction show similar patterns and, hence, support our findings discussed above.

By running separate regressions for NHS and SHI we examined whether these groups significantly differ in their rate of convergence (see Section 4.2). Although we do not find significant differences across these samples (the hypothesis of an equal β across NHS and SHI countries cannot be

Table 6: Conditional β convergence in $\ln publicgdp$ - panel data

Variable	(1) All	(2) NHS	(3) SHI	(4) 1970-1979	(5) 1980-1989	(6) 1990-2005
$\ln publicgdp_{t-1}$	0.852***	0.849***	0.814***	0.607***	0.716***	0.780***
	(0.021)	(0.028)	(0.044)	(0.061)	(0.076)	(0.040)
$publiccov$	−0.000	0.000	0.002	−0.000	0.001	0.007*
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.004)
$\Delta elderly$	0.029**	0.023*	0.057*	−0.102	0.029	0.039**
	(0.013)	(0.013)	(0.029)	(0.078)	(0.022)	(0.017)
$openc$	−0.000*	−0.001**	0.000	−0.002	−0.001	−0.001*
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
$govleft$	0.000	0.000*	−0.000	0.000	0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Delta \ln gdpcap$	−0.483***	−0.544***	−0.307	−0.663***	−0.505**	−0.426**
	(0.111)	(0.108)	(0.201)	(0.195)	(0.220)	(0.173)
Obs.	740	476	213	189	213	338
Adj. R^2	0.97	0.97	0.97	0.97	0.96	0.96
F-tests						
Country effects	2.14***	2.29**	2.06*	3.83***	1.54*	2.07***
Time effects	5.67***	4.08***	2.75***	10.66***	1.48	5.68***
$\beta_1 = 1$	48.18***	29.87***	17.50***	41.75***	13.97***	30.22***
χ^2*-test*						
Equal β_1		0.54				

Notes: Constant, country and time effects not reported. Robust standard errors in parenthesis. *, ** and *** indicate the 10%, 5% and 1% level of significance.

rejected), variations may occur considering even smaller entities. Therefore, we (i) further split the NHS countries into old and new NHS countries[17] and (ii) introduce interaction terms with the lagged dependent variable and all country dummies as suggested by Nixon (1999).

Columns (1) and (2) of Table A3 in the Appendix show the results for public financing in % of total HCF $\ln public$ using the NHS sample only. A χ^2-test reveals that the rate of convergence is significantly higher in old comparing to new NHS countries. However, when we introduce

[17] We classify those countries as old NHS countries which were already NHS-systems at the beginning of the observation period (Australia, Canada, Denmark, Great Britain, Finland, Iceland, Ireland, New Zealand, Norway, Sweden). Countries, which changed to a NHS-system during the past 36 years are defined as new NHS countries (Greece in 1983, Italy in 1978, Portugal in 1979, Spain in 1987).

the interaction of the convergence parameter with each country dummy (column(3)) and test whether the corresponding coefficients are jointly significant we cannot reject the H_0 hypothesis of jointly insignificant slope differences. Testing whether $\beta_1 = 1$ reveals that the H_0 cannot be rejected anymore for the total sample. This means that the series in this sample follows a random walk without any convergence/divergence patterns.

Columns (4) to (6) of Table A3 depict the results for public financing in % of GDP $\ln \textit{publicgdp}$. Here, we cannot reject the H_0 hypothesis of equal βs for the old and new NHS countries (see columns (4) and (5)). The country dummies in these two sub samples indicate that new NHS countries do not move towards a common mean. But for old NHS states a development towards a country specific level is observable. Furthermore, when we allow for different slope parameters for each country by including interactions we find evidence that the slopes and hence, the rate of convergence, is country specific too (column(6)).

5 Conclusions and suggestions for future research

Convergence in the health care financing is one source to promote workers' mobility, to harmonize policies and to boost cross border shopping within the health care sector. Hence, we are interested in learning about the corresponding convergence patterns. The analysis in this paper refers to the question whether the financing structure (public-private financing mix) of the health care systems in 23 OECD countries converges. To answer this research question we focus on the public financing ratio which we measure by two variables: public financing in % of total health care financing (HCF) and public financing in % of GDP.

Beside the focus of the hitherto disregarded financing side this paper contributes to the existing literature by providing a long-run perspective (36 years) of convergence patterns using a broad sample of 23 OECD countries. σ-convergence (measured as coefficient of variation), absolute and conditional β-convergence are used to examine whether public financing converges. We split this sample into sub groups to test whether different developments occur across the health care systems (NHS vs.

SHI) and time segments (1970-1979, 1980-1989, 1990-2005). Country specific characteristics are captured by dummy variables for each country as well as information on a country's public health insurance coverage, proportion of a country's population older than 65 years, openness of the economy, political orientation of the government and GDP per capita.

Our major finding is that convergence takes place. This conclusion is independent from the specification of the dependent variable (public financing in % of total HCF as well as in % of GDP), the different methods of testing for convergence (σ-convergence, absolute and conditional β-convergence) and the different assignments of countries to sub samples (NHS and SHI states). However, in both series country dummies included indicate a movement towards a different mean although this effect is not euqally pronounced for each dependent variable across the sub groups. Variations across sub samples also occur with respect to the rate of convergence. Separating the sample into NHS and SHI countries reveals that these two sub groups do not significantly differ in their rate of convergence. When we focus on a smaller sub sample of NHS countries (old and new NHS countries) we find a significant difference for the convergence coefficient regarding public financing in % of total HCF. Splitting the observation period into three time segments highlights that the rate of convergence is decreasing over time.

Our tests show that the characteristics we used to control for conditional convergence are only partially significant while the country fixed effects are of higher relevance. This is in line with our theoretical reasoning and an indication for the significance of those parts of the institutional design of the health care system, we were not able to control for explicitly.

However, the change in the level and share of public financing only gives a first impression of the convergence issue in health care financing. For a deeper understanding of the determinants and effects of convergence we have to consider how the relationship between public and private financing is structured in detail. There exist at least five basic designs of this relationship: (i) Parallel public and private financing systems: for a given range of services a separate privately financed system exists as an alternative to public financing. (ii) Co-payment: Across a broad range of services, financing is partially subsidized through public payment, with the remainder financed through out-of-pocket (OOP) payment or private health insurance. The degree of co-payment can follow different schedules and may be scaled according to the income and/or other individual characteristics of the patient. (iii) Group-based: Certain population groups are eligible for public coverage, others rely on private health insurance or are free to choose private options. (iv) Sectoral: Certain health care sectors are entirely financed publicly (e. g. inpatient care) while others mainly rely upon private finance (e. g. pharmaceuticals). (v) In addition to the differences in the private-public relationship the internal structure of public (tax and/or SHI) and private (private health insurance and/or OOP) seems to be important.

In a nutshell this means that the same levels or shares of public financing we observe in reality are compatible with different links in the designs (i) to (v).The approaches to explain the public-private financing structure offered so far (see Gouveia 1996, Clemente et al. 2004) do not account for this institutional diversity. E. g., in the Gouvea-Model the private sector only acts as a complement to an obligatory publicly financed health care sector and only consists of private health insurance. OOP payments which account for a substantial part of private health care financing in reality are not included in their political economic perspective.

We are convinced that deeper insights into the convergence issue could be derived by studying the financing structure in more detail. On the one hand, this means splitting up public/private financing into its most important building blocks. On the other hand, it seems to be promising to take a closer look at the financing structure in the different sectors of health care provision such as outpatient care, inpatient care and pharmaceuticals.

This detailed analysis of the financing structure requires disaggregated data about HCF (public-private relationships). No reliable data on the dimensions mentioned are available for the time period 1970 – 2005. Information on a very limited sample of OECD-countries exists only since 1990. However, a disaggregated study needs to be on future research agendas to capture and understand the ongoing processes in HCF in their complexity.

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Appendix

Figure A1: Average public financing in % of total HCF

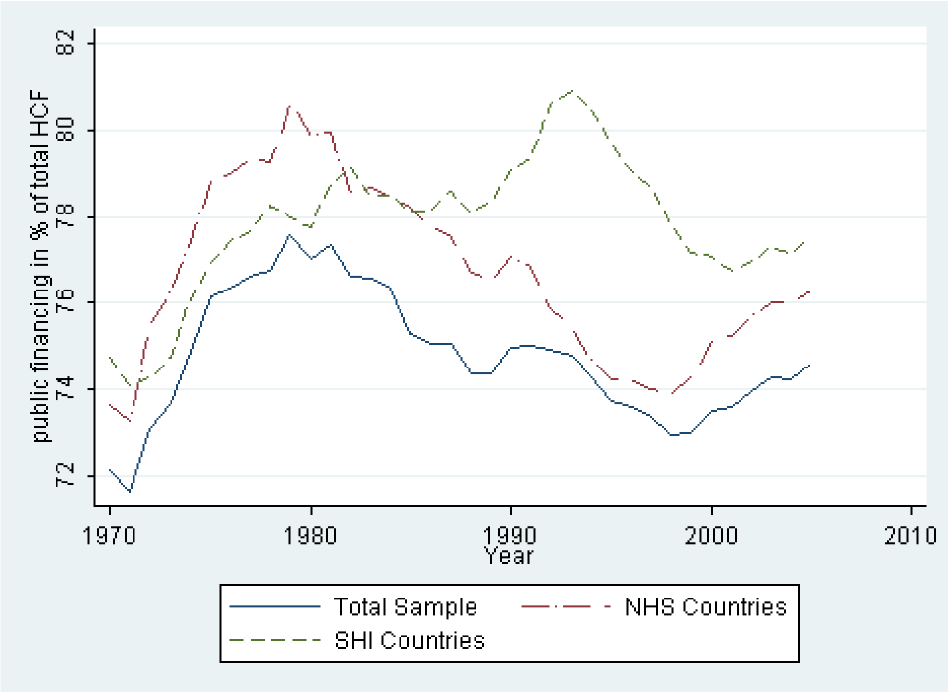

Figure A2: Average public financing in % of GDP

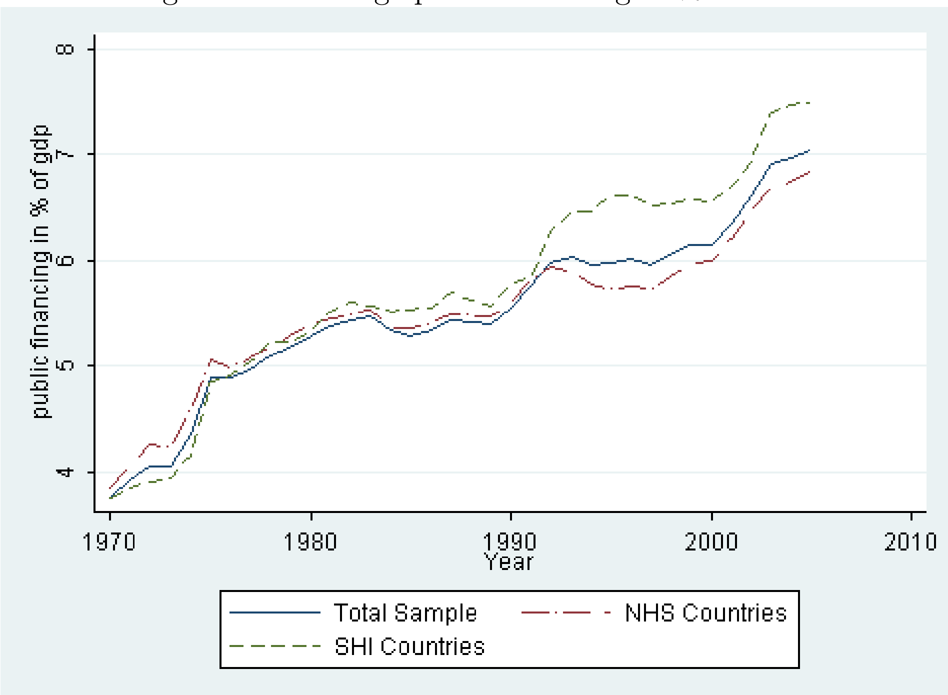

Figure A3: Average growth rate of public financing in % of total HCF

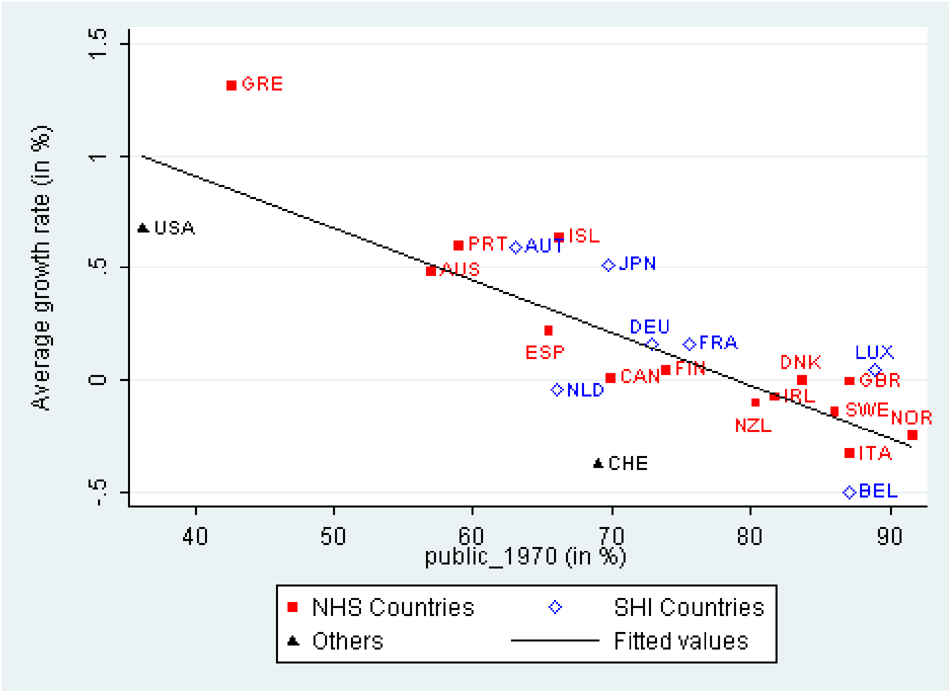

Figure A4: Average growth rate of public financing in % of GDP

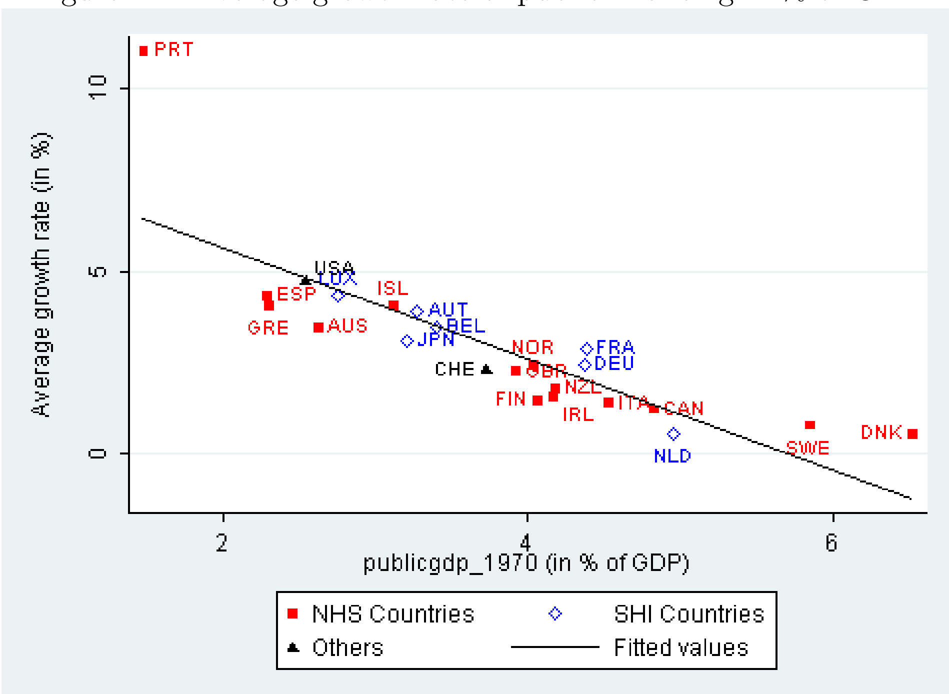

Table A1: Conditional β convergence in $\ln public$ - Kiviet correction

Variable	(1) All	(2) NHS	(3) SHI	(4) 1970-1979	(5) 1980-1989	(6) 1990-2005
$\ln public_{t-1}$	0.894***	0.877***	0.887***	0.553***	0.830***	0.922***
	(0.024)	(0.025)	(0.034)	(0.063)	(0.060)	(0.055)
publiccov	−0.000	−0.000	−0.000	0.001	−0.001	−0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.005)
$\Delta elderly$	0.010	0.011*	0.019**	−0.025	0.003	0.009
	(0.008)	(0.006)	(0.010)	(0.036)	(0.025)	(0.007)
openc	0.000	0.000	−0.000**	−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
$govleft$	0.000***	0.000**	−0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Delta \ln gdpcap$	0.015	0.062	−0.103	−0.080	−0.008	0.050
	(0.056)	(0.039)	(0.078)	(0.072)	(0.123)	(0.059)
Obs.	740	476	213	189	213	338

Notes: Constant and time effects not reported. Bootstrap standard errors in parenthesis. *, ** and *** indicate the 10%, 5% and 1% level of significance.

Table A2: Conditional β convergence in $\ln publicgdp$ - Kiviet correction

Variable	(1) All	(2) NHS	(3) SHI	(4) 1970-1979	(5) 1980-1989	(6) 1990-2005
$\ln publicgdp_{t-1}$	0.892***	0.889***	0.859***	0.725***	0.886***	0.869***
	(0.022)	(0.021)	(0.038)	(0.053)	(0.076)	(0.035)
publiccov	−0.001	−0.000	0.000	−0.001	−0.002	0.006
	(0.000)	(0.000)	(0.002)	(0.001)	(0.001)	(0.007)
$\Delta elderly$	0.026**	0.021**	0.052***	−0.106**	0.012	0.035***
	(0.012)	(0.010)	(0.015)	(0.052)	(0.031)	(0.011)
openc	−0.000**	−0.000	0.000	−0.001	−0.001	−0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
$govleft$	0.000***	0.000**	−0.000**	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Delta \ln gdpcap$	−0.472***	−0.539***	−0.294**	−0.677***	−0.491***	−0.433***
	(0.086)	(0.061)	(0.118)	(0.126)	(0.149)	(0.102)
Obs.	740	476	213	189	213	338

Notes: Constant and time effects not reported. Bootstrap standard errors in parenthesis. *, ** and *** indicate the 10%, 5% and 1% level of significance.

Table A3: Conditional β convergence in $\ln public$ and $\ln publicgdp$ – panel data

	Public financing					
	in % of total HCF			in % of GDP		
Variable	(1) newNHS	(2) oldNHS	(3) All	(4) newNHS	(5) oldNHS	(6) All
$\ln public_{t-1}$	0.867***	0.734***	0.939***			
	(0.059)	(0.068)	(0.096)			
$\ln publicgdp_{t-1}$				0.874***	0.812***	0.802***
				(0.050)	(0.030)	(0.056)
publiccov	−0.001	−0.000	−0.000	−0.000	−0.001	−0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$\Delta elderly$	0.018	−0.011	0.012	0.028	−0.015	0.037**
	(0.016)	(0.014)	(0.009)	(0.020)	(0.023)	(0.014)
openc	0.001	0.000	−0.000	0.000	−0.001	−0.001***
	(0.001)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)
govleft	0.000*	0.000	0.000**	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Delta \ln gdpcap$	0.067	−0.034	−0.011	−0.491**	−0.686***	−0.491***
	(0.172)	(0.063)	(0.057)	(0.243)	(0.101)	(0.115)
Obs.	136	340	740	136	340	740
Adj. R^2	0.95	0.94	0.97	0.96	0.96	0.97
F-tests						
Country effects	1.41	1.78*	0.96	1.68	3.74***	2.72***
Time effects	1.14***	1.52**	1.16	1.44*	4.15***	5.92***
$\beta_1 = 1$	5.09**	15.33***	0.41	6.28**	39.08***	12.57***
Slopes = 0			0.95			3.08***
χ^2*-test*						
Equal β_1	2.80*			1.52		

Notes: Constant, country and time effects not reported. Robust standard errors in parenthesis. *, ** and *** indicate the 10%, 5% and 1% level of significance.