FEDERALISM
AND REGIONAL HEALTH CARE EXPENDITURES:
AN EMPIRICAL ANALYSIS FOR THE SWISS CANTONS

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Abstract

Switzerland (7.2 million inhabitants) is a federal state composed of 26 cantons. The autonomy of cantons and a particular health insurance system create strong heterogeneity in terms of regulation and organisation of health care services. In this study we use a single equation approach to model the per-capita cantonal expenditures on health care services and postulate that per-capita health expenditures depend on some economic, demographic and structural factors. The empirical analysis demonstrates that a larger share of old people tends to increase health costs and that physicians paid on a fee-for-service basis swell expenditures, thus highlighting a possible phenomenon of supply induced demand.

Keywords: federalism; regional health expenditures; panel data analysis.

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1. Introduction

Switzerland is a federal state, with three distinct layers of government: Federal, Cantonal (26 cantons), and Local (about 2,700 municipalities or communes). Each government tier is assigned a precise range of functions and competences, supported by the right to levy taxes, by means of which it meets its own expenditure requirements. Since 1996 the Confederation, empowered by the Federal Health Insurance Law (FHIL), has played a more active role in the health care system. In particular, the new legislation made a health insurance scheme mandatory for all residents, its benefit basket being determined by the Confederation. Notice that the organisation of the health care system remains nonetheless under the responsibility and control of the individual cantons.

In 2002, health care costs in Switzerland soared to SFr 48 billion, that is 11.1% of GDP. With a rise of 2.9 percentage-points in the period 1990-2002, Switzerland experienced – despite its very high level of decentralisation [a] – the widest divergence between the growth rates of health care costs and GDP of all OECD countries. Moreover, decentralisation of competences and of expenditure responsibility in Switzerland has led to a series of significant differences among the 26 cantons in terms of per-capita health expenditures. The aim of this study is to analyse the determinants of these differences. The paper is structured as follows: in section 2 we present the main features of the Swiss health care system; in sections 3 and 4 we discuss the specification of the model and submit the empirical estimate results of the panel data set. Conclusions are drawn in section 5.

2. The Swiss health care system

The Swiss health care system is based on a mixed (private-social) health insurance system and underwent a major reform in 1996, when the FHIL came into force. The main characteristics can be summarized in the following five points:

1. Health insurance has been mandatory for all residents since 1996, and is run by about 90 competing private insurance companies.

2. Although the package of services covered by the mandatory insurance is laid down in the insurance contracts, since 1996 the basic contract has been, by law, the same for all residents.

3. Premiums are based on community-rating. Health insurers can fix the amounts at the cantonal level, but this decision has to be ratified by a federal authority.

4. Since premiums are not commensurate with the insured's ability to pay, in order to reduce the social impact of per-capita payments, the FHIL of 1996 introduced State subsidies fully covering the insurance premium for persons with a low income. It is worth mentioning that in some cantons means-tested subsidies are granted to over 40% of the population.

5. In Switzerland the financing of the health system is particularly regressive and performed by a large number of third-party payers. [b] Overall only one third of the financing is collected in an income-dependent way. Moreover, public contribution is provided

predominantly by cantons and municipalities, whereas the Confederation's contribution is only 20% of the public health care budget. Federalism and multiple payers make the financial flows extremely complex to follow, which in turn makes health care expenditures more difficult to manage in general, and determines a *cost shifting* problem.

Decentralisation of competences and expenditures has led to a series of significant inter-cantonal differences. If we focus on the supply-side, we find vast disparities in the density of medical practices. The data range from over 300 medical practices per 100,000 inhabitants (in Basel-City and Geneva) to 100-110 practices per 100,000 inhabitants (in rural areas of Central Switzerland), while the national average is 172. A similar figure holds for the density of acute beds. Swiss cantons also differ from the point of view of outcome indicators, as for instance mortality rates amenable to health care. Equally very significant is variability in socialized health expenditures, which account for services covered by the mandatory health insurance premiums as well as public health expenditures. The differences are very much greater than those registered in other federal States, for example the Canadian Provinces [2]. Data for 2001 (see figure 1) range from per-capita 1051 PPP-US$ in the Canton Appenzell to nearly threefold (2781 PPP-US$) in Geneva. Another source of variation across cantons regards equity of financing. Looking at a representative household of four people (two adults and two children) with a gross income of 45,000 euros and choosing the health insurer

with average cantonal premiums, the share between net premiums and disposable income ranged from 1.5% in Valais to 14% in Geneva in 2002.

Figure 1 about here.

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3. Model specification and estimates

In this study we use a single equation approach to model the per-capita cantonal expenditures on health care services. We postulate that per-capita health expenditures depend on some economic, demographic and structural factors. Following the model specifications used in previous studies[c] and taking into account the availability and quality of data for the Swiss cantons, we decided to specify the following parsimonious cantonal health expenditures model using a log-log functional form:

$$SHE_{it} = f\,(Y_{it}, UN_{it}, PO_{it}, A75_{it}, A05_{it}, MO_{it}, DP_{it}, DDI_{it}, PHY_{it}, BEDS_{it}, DLAT_{it,}\ T) \quad (1)$$

where subscript *i* stands for the canton and *t* for the year. [d] Moreover,

SHE_{it} = socialized health expenditures per capita (obtained by adding together per-capita public health expenditures and expenses covered by the mandatory insurance);

Y_{it} = per-capita income;

UN_{it} = unemployment rate, calculated as the ratio of the unemployed over the working population;

PO_{it} = poverty rate, calculated as the percentage of households with an income below 50% of the average cantonal income; [e]

$A75_{it}$ = percentage of population older than 75;

$A05_{it}$ = percentage of population aged under 5;

MO_{it} = mortality rate amenable to health care. This rate is based on the concept that deaths from certain causes should not occur in the presence of timely and effective health care; [f]

DP_{it} = population density, calculated as the ratio of the population to the Canton's surface area;

DDI_{it} = cantonal index for direct democracy. Direct democracy is defined in terms of individual political participation opportunities. The index was calculated by [9] and [10]; [g]

PHY_{it} = physician density (physicians per 100,000 inhabitants);

$BEDS_{it}$ = density of acute beds in hospitals per 100,000 inhabitants;

$DLAT_{it}$= dummy variable that takes the value 1 for Latin cantons (French or Italian speaking cantons), 0 otherwise; [h]

T = time variable expected to capture the cost differences over time owing to changes in medical technology or to other factors that may influence the development of health costs at the national level.

4. Data and estimation results

The econometric estimation of model (1) is based on a combination of time-series and cross-section data for 26 cantons over the period 1996-2002. [i] These data were obtained from annual publications by the Swiss Federal Statistical Office [3] and from yearly publications by Santésuisse, an association of all insurance companies. [j] Note that, for certain variables, only one value is available for the whole period analysed. These variables are: poverty rate, mortality rate, and index of direct democracy. Therefore model (1) includes these three time-invariant variables.

Equation (1) is estimated by applying a log-log functional form and using the fixed-effects model (LSDV) and the random-effects model (GLS). [k] Table 1 presents the final regression results.

Table 1 about here.

The Hausman test checks the null hypothesis that *the explanatory variables* and the individual-specific error terms are uncorrelated. The result of the test shows that the differences in coefficients between the two models are not systematic thus implying that the random effects model is to be preferred and that $E(\alpha_i \mid X) = 0$. Moreover, the within variation of most variables included in the model is relatively low and this could imply a low

statistical efficiency of the fixed effects model. Therefore the following comments are based on the results obtained with the GLS model. [l] Most of the coefficients are statistically significantly different from zero and carry the expected sign. The log-log transformation allows us to consider the estimated coefficients as elasticities. The estimation with the random effects model points out that the income elasticity is negative but not significantly different from zero. At first sight, this result may appear surprising, since in the international literature [2, 14, 15] income elasticity is normally highly significant and bears a positive sign. The lack of statistical significance of income coefficient may be due to the fact that the dependent variable considers only the expenditures covered by the mandatory (basic) health insurance plan, which by law entitles policy holders to the same benefit basket whatever their Canton [m]

The coefficients for cantonal rates of unemployment and poverty are not statistically significant. [n] These results could be explained by the fact that poverty and unemployment rates in Switzerland are lower than in other European countries. Moreover, the impact of these two variables on the per-capita expenditures might be captured, at least partially, by the dummy variable DLAT. In fact, levels of unemployment and poverty in Latin cantons are generally higher than in the German-speaking cantons.

The coefficient for the percentage of population aged over 75 is positive and significantly different from zero at the 99% confidence level. This result confirms the hypothesis that an older population tends to cause higher health

expenditures, because of the increased incidence of illnesses such as insanity or other chronic diseases, as well as proximity to the time of death of the elderly. [o] The percentage of children under the age of 5 is negative and statistically significant at the 90% confidence level. The level of health expenditures also depends on the mortality rate ascribable to health care. This is an important variable because it may be considered as a proxy variable for the outcome of a health care sector. As expected, it has a negative sign and is statistically different from zero at the 90% confidence level. As the mortality rate amenable to health care rises, health outlays tend to diminish. We infer that when preventable deaths increase less money is spent within the health care system to forestall such events. Another important factor that explains our model is the cantonal population density. This variable has been used as a proxy for the urbanisation level in each region of Switzerland. It is highly significant and carries a positive sign.

In the public choice literature, it is argued that the more citizens can express their preferences, the more public goods will be fashioned according to their tastes [18-21]. [p] However the direct democracy index included in the model does not capture this effect.

The elasticity of physician density has a positive value. In other words, an increase in the number of physicians has a positive impact on cantonal health expenditures. The latter result may highlight a potential supply-induced demand problem. In fact, doctors are paid through a fee-for-service

scheme; consequently there may be an incentive to expand the number of services provided to patients as physician density goes up. [q] The coefficient for bed density is not statistically significant and has a negative sign. [r]

The dummy variable for Latin cantons is positive and statistically significant at the 99% confidence level. In these cantons per-capita health expenditures tends to be higher than in the German speaking areas of the country, thus confirming previous findings of [24]. This result seems to reflect a cultural and structural difference between these Swiss regions.

Time variable T is positive and significantly different from zero.

5. Conclusions

Our study shows that in Switzerland, where the principle of federalism is very deep-rooted and deeply felt by the whole population, decentralisation of the health care sector has generated significant differences between cantons in terms of per-capita health expenditures, funding equity, and supply structure. Moreover, the empirical analysis demonstrates the impact of physician density on health expenditures (possible supply-induced demand phenomenon in a system where ambulatory care is reimbursed on a fee-for-service basis). This means that by changing physician density it should be possible to influence the per-capita health expenditures. Generally, we can identify two instruments that may be used by the federal government to modify physician density. First, the federal government may decide to remove compulsory contracting – a federal regulation which these days forces insurance companies to contract with every physician. This would

probably reduce both the fee-for-service remuneration and regional disparities in physician density. [s] Second, the federal government may play a stronger role in organising the health care system, e.g. by explicitly planning the number of physicians authorised to operate in the different cantons. [t]

Another important factor that may explain the difference in the cantonal health care expenditures is the percentage of over 75 in the population, which cannot be influenced by health policies. It is our belief that, faced with an ageing population exhibiting regional differences, a more active financial intervention by the central state would be highly desirable in order to avoid fiscal distress at the cantonal level.

Overall, a more active role of the Confederation would promote a more coordinated and efficient organisation of the health care sector, while preserving the principle of federalism, in order to establish national priorities.

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Notes

[a] Decentralisation is seen as an essential tenet of health sector reform in many European countries. It is considered an effective way to stimulate improvements in service delivery, to secure better allocation of resources according to needs, to involve the community in decision about priorities, and to reduce inequities in health care provision.

[b] For a comprehensive review of equity issues in health care financing please refer to [1].

[c] For a review of the literature on the determinants of per-capita health expenditures in OECD countries see [5].

[d] Compared to the model used by [6], model (1) includes the following additional variables: poverty rate, mortality rate, population density, index for direct democracy, and a dummy variable for the Latin cantons. Moreover the sample now covers the period 1996-2002, for a total of 182 observations.

[e] See [7] for a discussion on different measures of poverty.

[f] See [8] for a more detailed discussion on this issue.

[g] The direct democracy index is indicated by the public choice theory as a means for individuals to express their preferences over public issues, especially in a decentralized context.

[h] In a preliminary version of the model we included as explanatory variable also a dummy for cantons with a university hospital. However, this variable turned out to be statistically not significant and was left out of the final model specification.

[i] It is worth pointing out that some variables of the model show a high within variation while others show a low within variation.

[j] For more detailed statistics see [11].

[k] See [12].

[l] One concern that could be raised is the possible endogeneity of the "physician density" variable, e.g. the presence of a correlation between the individual specific disturbance and the physician density variable. In order to test this potential problem we estimated the model using the approach proposed by [13]. The econometric results obtained with this approach

generally confirm those obtained using the random effects approach. The coefficient of the physician density variable is still significant (significantly different from zero at the 90% confidence level). However, we believe that due to the low within variation of several explanatory variables, the relevant model for the purpose of this study is that presented in table 1.

[m] The mandatory and basic insurance covers virtually all medical services. Citizens are also offered an additional private insurance, which primarily offers free choice of hospital doctor and a superior level of hospital accommodation (in single or double bedrooms). Moreover, up to 2001 these private insurance plans also covered, in the private wards of public hospitals, the part of hospital expenditures normally financed by the state.

[n] For a more detailed discussion of this issue please refer to [16].

[o] See [17].

[p] Remember that in Switzerland popular initiatives and referenda are a central part of the democratic life of the country, and they are very frequently used. Citizens may also call a referendum on issues like cantonal hospital planning.

[q] For further details on the supplier-induced demand theory see [22-23]. Furthermore, it is worth pointing out that the impact of physician density on the per-capita socialized health expenditures, associated with a fee-for-service scheme, confirms the results obtained by [14].

[r] Noticeably, the correlation between bed density and physician density is low. Therefore, the fact that the coefficient of bed density is not significant cannot be explained by a high correlation of these two variables.

[s] The proposal of deregulating the contractual relationships between physicians and health insurers is being discussed in the Swiss parliament at the moment (see[25]).

[t] On 4 July 2002, the Federal Council issued a moratorium on the opening of new medical practices, to be enforced by the individual cantons. In fact, since the concession of independent practices cannot be blocked, it was decided to deny new medical practitioners the right to invoice their services to the sickness funds. Originally set to expire on 3 July 2005, the moratorium was extended until summer 2008. It affects all medical practitioners (Swiss and European) indiscriminately and, though limited in time, raises barriers to market access, an advantage for medical practitioners who already practise and a foil to competition.

References

1. Wagstaff A *et al*. Equity in the Finance of Health Care: Some Further International Comparisons. *J Health Econ* 1999; 18: 263-290.

2. Di Matteo L, Di Matteo R. Evidence on the Determinants of Canadian Provincial Government Health Expenditures: 1965-1991. *J Health Econ* 1998; 17: 211-228.

3. Swiss Federal Statistical Office. *Kosten des Gesundheitswesen*, Neuchâtel, 2003.

4. Federal Office for Social Security. *Statistiques de l'assurance maladie 2001*, Bern, 2002.

5. Gerdtham UG, Jönsson B. International Comparisons of Health Expenditure: Theory, Data and Econometric Analysis, In *Handbook of Health Economics*, Culyer AJ, Newhouse JP (eds). Elsevier Science Publishers: Amsterdam, 2000; 11-53.

6. Crivelli L, Filippini M, Mosca I. Federalismo e spesa sanitaria regionale: Analisi empirica per i cantoni svizzeri. In *Welfare state e decentramento fiscale*, Franco D, Zanardi, A (eds). Franco Angeli: Milano, 2003; 123-147.

7. Connolly S, Munro A. *Economics of the Public Sector*. Prentice Hall: London, 1999.

8. Nolte E, McKee M. Measuring the Health of Nations: Analysis of Mortality Amenable to Health Care. *Br Med J* 2003; 327: 1129.

9. Trechsel A, Serdült U. *Kaleidoskop Volksrechte: Die Institutionen der direkten Demokratie in den schweizerischen Kantonen 1970-1996*, Helbling & Lichtenhahn: Basel, Genf and Munich, 1999.

10. Frey B, Stutzer A. Happiness, Economy and Institutions, *Econ J* 1999; 110: 918-938.

11. Swiss Federal Statistical Office Website. http://www.bfs.admin.ch (intramuros statistics and database Statweb)

12. Greene WH. *Econometric Analysis*. Prentice Hall: New York, 2003.

13. Amemiya, T, MaCurdy T.E. Instrumental-Variable Estimation of an Error-Components Model. *Econometrica* 1986; 54(4): 869-880.

14. Gerdtham UG, Jönsson B, MacFarlan M, Oxley H. The Determinants of Health Expenditure in the OECD Countries. In *Health, The Medical Profession and Regulation*, Zweifel P (ed.). Kluwer: Dordrecht, 1998; 113-134.

15. Manning WG *et al*. Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment, *Am Econ Rev* 1987; 77(3): 251-277.

16. Swiss Federal Statistical Office. *Enquête suisse sur la santé*. Berne, 2002.

17. Zweifel P, Felder S, Meier M. Ageing of population and health care expenditure: A red herring? *Health Econ* 1999; 8: 485-496.

18. Oates WE. *Fiscal Federalism*, Harcourt Brace Jovanovich: New York, 1972.

19. Oates WE. An Essay on Fiscal Federalism, *J Econ Lit* 1999; 37: 1120-1149.

20. Leu RE. The public-private mix and international health care costs. In *Public and Private Health Services*, Culyer AJ, Jonsson B (eds). Basil Blackwell: Oxford, 1986.

21. Frey B. Direct Democracy: Politico-economic Lessons from Swiss Experience, *Am Econ Rev* 1994; 84(2): 338-342.

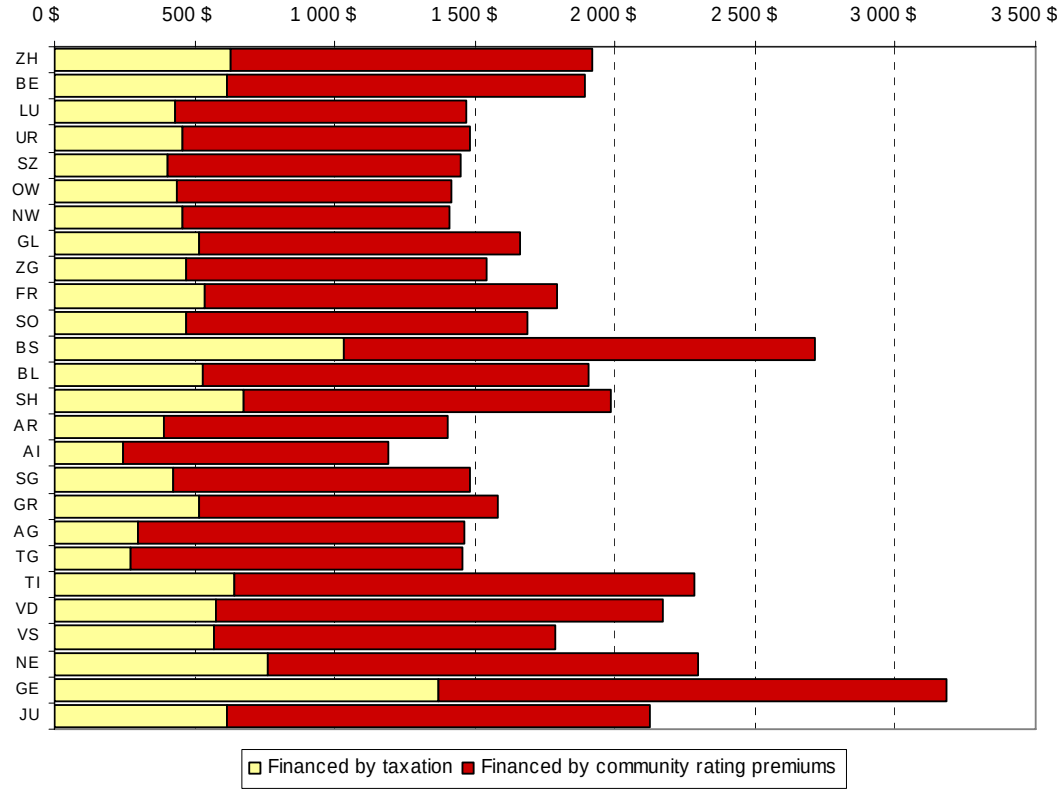
22. McGuire T. Physician Agency. In *Handbook of Health Economics*, Culyer AJ, Newhouse JP (eds). Elsevier Science Publishers: Amsterdam, 2000; 461-536.

23. Domenighetti G *et al*. Dépense et maîtrise des coûts sanitaires en Suisse, *Schweiz Arzteztg* 1997; 78(16): 588-593.

24. Vatter A, Rüefli C. Do Political Factors Matter for Health Care Expenditure? A Comparative Study of Swiss Cantons. *J Public Policy* 2003; 23(3): 301–323.

25. International Network for Health Policy and Reform Website. http://www.healthpolicymonitor.org [31 May 2005]. Crivelli L. *Contracting Freedom for Health Insurers*. Switzerland. Survey (3) 2004.

Figure 1 Per-capita socialized health expenditures in Swiss cantons (2002), PPP-US$



Source: Swiss Federal Statistical Office [3], Federal Office for Social Security [4], Santésuisse.

Caption:
AG (Aargau), AI (Appenzell-Inner Rhodes), AR (Appenzell-Outer Rhodes), BS (Basel City), BL (Basel Land), BE (Bern), FR (Fribourg), GE (Geneva), GL (Glarus), GR (Graubünden), JU (Jura), LU (Lucerne), NE (Neuchâtel), NW (Nidwalden), OW (Obwalden), SH (Schaffhausen), SZ (Schwyz), SO (Solothurn), SG (St. Gallen), TG (Thurgau), TI (Ticino), UR (Uri), VS (Valais), VD (Vaud), ZG (Zug), ZH (Zurich).

Table 1 Econometric results

Coefficients	**LSDV model Cantonal Health Expenditure**	**GLS model Cantonal Health Expenditure**
β_0 Constant	7.522***	8.425***
	(1.213)	(0.941)
β_1 Y	- 0.115*	- 0.082
	(0.069)	(0.061)
β_2 UN	0.008	0.011
	(0.012)	(0.011)
β_3 PO	-	0.056
	-	(0.134)
β_4 A75	0.227*	0.351***
	(0.121)	(0.093)
β_5 A05	- 0.097	- 0.231*
	(0.144)	(0.127)
β_6 MO	-	- 0.240*
	-	(0.133)
β_7 DP	0.209	0.071***
	(0.138)	(0.021)
β_8 DDI	-	- 0.100
	-	(0.110)
β_9 PHY	0.159	0.179**
	(0.111)	(0.090)
β_{10} BEDS	- 0.018	- 0.010
	(0.015)	(0.015)
β_{11} DLAT	-	0.275***
	-	(0.079)
β_{11} T	0.037***	0.032***
	(0.004)	(0.004)
Within R^2	0.860	0.857
Between R^2	0.453	0.879
Overall R^2	0.488	0.876

*, **, ***: significantly different from zero at the 90, 95 and 99% confidence level.