Comparative, dynamic efficiency of national healthcare systems

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Abstract

The paper is an ex post, critical contribution to the research conducted by the World Health Organisation on healthcare financing. The issue of national healthcare systems' efficiency is addressed, through building a model of change in healthcare quality, in response to changes in healthcare financing, with the core hypothesis stating that the greater is the change in healthcare expenditures, the lesser is their efficiency in terms of healthcare quality improvement. Then, empirical evidence is provided, with econometric research proving the robustness of the model; further, qualitative research provides strong presumptions to a more general thesis, namely that healthcare systems bear significant transaction costs, proportional to their demographically defined size. Thus, important, and negative effects of scale are to assume in healthcare financing.

Keywords: healthcare; institutions; efficiency

JEL codes: I1, G28, H41

1. Introduction

The World Health Report, issued by the World Health Organisation in 2010, announces that from 20% to 40% of financing going to healthcare systems is wasted, in the sense that it does not contribute to deliver proper healthcare as such. The necessity to assure universal coverage, especially in developing countries, goes along with the imperative to go tight on healthcare expenses. Improving efficiency seems to be the core challenge for healthcare systems all over the world (WHO 2010[1]). The present paper is an *ex post*, scientific contribution to WHO research, with a special focus on both efficiency, and sustainability of national healthcare systems. In any given country, one the most basic, public decision-makers' headaches boils down to the following question: "how much will be enough, next year, to make that whole health business work properly?" Paraphrasing the well-known Paul Krugman's metaphor about trade, if some politician in United States declared that they are able to supply to their fellow citizens hospital healthcare at half the current cost, with quality held constant, they would be immediately elected president. The moment that said fellow citizens discovered that the scheme consists in sending American patients to Paraguayan hospitals, the person in question would be immediately subject to impeachment, and possibly to criminal prosecution. That is quite the issue that the present paper attempts to explore, i.e. the mutual link between healthcare expenditure, and the quality of healthcare, bearing in mind the broadly spoken institutional context. The question is relevant for both healthcare policy, and fiscal policy, as money spent on healthcare is among the most significant categories of public expenditure, *ergo* among the most important factors of public debt accumulation.

Before going more in depth into the literature, a preliminary clarification of the "healthcare financing" concept seems necessary. Basically, the economic concept of financing refers to the input of capital to the production function; in other words, to investment, and to financial markets. The jargon of healthcare policy uses the term "financing" in a different manner, referring to all payments received by the suppliers of healthcare products and services, in exchange of said product and services. From the purely economic point of view, such a kind of "financing" is the same that supply, or production in product markets. Henceforth, financing of healthcare, as understood in WHO research, corresponds to the output of the production function, not to its capital input. A substantial part of healthcare expenditures is made from pooled funds, on the grounds of general contracts with the suppliers of healthcare products and services. These contracts bear ambiguous characteristics. Technically,

[1] Health Systems Financing. The path to universal coverage, World Health Report, World Health Organisation, 2010

they consist in buying healthcare goods in bundles, in wholesale quantities so to say. However, for many suppliers, especially for publicly owned medical operators, these contracts are the basis of their solvency, and of their ability to invest. These contracts are the equivalent of the Keynesian effective demand, and the anticipation of their future value and specific provisions is the grounds, on which the suppliers of healthcare goods plan supply, and investment. The concept of healthcare goods, introduced in the previous sentence, seems, by the way, adequate for grasping the variety that hides behind the term "healthcare financing". The most spontaneous association with healthcare financing is money paid for medical services. However, a substantial part of healthcare financing serves to refund, totally or partially, the value of drugs, and medical equipment (for example glucometers) supplied in the given national market. Summing up it is to keep in mind that whenever the concept of "healthcare financing" is discussed, it refers to a hybrid, institutional system that encompasses a broad range of contracts, heterogeneous both in nature and in scale.

Over 2000 – 2008, most countries in the world significantly increased their healthcare expenses per capita. In the world as a whole, average healthcare expenses per capita, measured in US$ PPP, had grown from 566 to 899, which means that the global network of healthcare systems had absorbed, roughly speaking, an additional 2,5 trillion US$ PPP. In the same time, average life expectancy of the global population had grown just by 3%, from 66 to 68 years. The financial input seems to be disproportionally high in comparison to the human output, so to say. In most countries, the growth of healthcare expenditures has been absorbed principally by the public pooled funds, frequently at the expense of the private sector (WHO 2011[2]). For example, in Australia, 22,25 billions of Australian dollars PPP were injected in the healthcare system over eight years, in addition to the previously spent 58,5 billions a year, with life expectancy having grown by just 2,5%, from 80 to 82 years. Out of these 22 billions, 13,7 were absorbed by the public healthcare system, and 8,5 were the growth of the private healthcare market.

The line of research represented by the World Health Organisation focuses mostly on assuring universal coverage in healthcare, which is closely connected to modalities of financing. The private, out-of-pocket system of payments for healthcare services (OOP) makes almost 50% of the global financing of healthcare systems, and is visibly, inversely proportional to the given country's level of income. In high – income countries, the share of OOP in the total health expenditure (THE) is barely above 36%, to reach some 70% in upper middle-income countries, and exceeding 85% in lower-income ones (Falkingham 2004[3]; Dummer, Cook 2007[4]; Durairaj et al.

[2] World Health Organisation, 2011, World Health Statistics
[3] Falkingham, J., 2004, Poverty, out-of-pocket payments and access to health care: evidence from Tajikistan, Social Science & Medicine, 58(2), pp. 247-258
[4] Dummer, T., J., B., Cook, I., G., 2007, Exploring China's rural health crises: Processes and policy implications, Health Policy, 83, pp. 1-16

2010a[5]). Efficiency of healthcare financing greatly depends on the efficiency in the actual supply of healthcare services. No system of financing is efficient per se. An important issue is the link between money and infrastructure. Significant path dependence is to notice: new directions of financing can hardly create new infrastructure, but the existing infrastructure tends to attract financing (Durairaj et al. 2010b[6]). It has been proven possible to build highly efficient, demand-based healthcare systems, for example in Chile. Such systems require, however, well-developed information systems to be effective (Missoni, Solimano 2010[7]). There is significant substitution, in households' budgets all over the world, between the consumption of privately paid healthcare, and other goods (Kabawata et al. 2002[8]; Saksena et al 2010[9]). It seems that private health insurance, in comparison to simple out-of-pocket direct payment for healthcare, improves the overall availability of healthcare (Saksena et al. 2010). Pooled funds play a significant role in financing healthcare systems. From the political point of view, social acceptance of redistribution in financing healthcare is an important factor of success in creating and maintaining pooled funds. There is a body of evidence, which suggests that the social acceptance in question is, firstly, highly country-specific, even at the same level of income per capita, and, secondly, that the most widely accepted pattern of pooling is the coverage of approximately the half of the total healthcare expenses through various means of financial solidarity (James, Savedoff 2010[10]). There is a sharp difference between the potential, and the effective demand for healthcare. The latter depends on the given population's willingness to actually use healthcare services, which, in turn, seems to be proportional to the broadly defined social status, education included (Gakidou et al. 2010[11]; Xu et al. 2010a[12]). There is a body of research, which aims at defining the optimal level, and institutional mix of healthcare expenses. Some findings suggest that a mix of 5 – 6% of the GDP spent on healthcare by the government, combined with out-of-pocket payments making some 15 – 20% of the total health expenditure, assure high efficiency and sustainability of the healthcare system. The same research indicates that only high and upper-middle income countries are able to work out actual, institutional mix of healthcare expenditures close to that ideal. The same countries display a clear tendency of

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[8] Kawabata, K., Xu, K., Carrin, G., 2002, Preventing impoverishment through protection against catastrophic health expenditure, Bulletin of the World Health Organization, 2002;80(8):612

[9] Saksena, P., Fernandes Antunes, A., Ke Xu, Musango, L., Carrin, G., 2010, Impact of mutual health insurance on access to health care and financial risk protection in Rwanda, World Health Report (2010), Background Paper, 6.

[10] James, Ch., Savedoff, W., 2010, Risk Pooling and Redistribution in Healthcare: An Empirical Analysis of Attitudes Toward Solidarity, World Health Report (2010), Background Paper ,5, World Health Organisation

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[12] Ke Xu, Saksena, P., Evans, D., B., 2010, Health Financing and Access to Effective Interventions, World Health Report (2010), Background Paper, 8, World Health Organisation

healthcare expenditures to grow faster than the GDP, a pattern not to encounter in low – income countries. Moreover, private out-of-pocket healthcare expenses grow faster that the public ones, and the former are elastic to the latter, in a proportion above 1,00, without obvious elasticity in the opposite direction (Musgrove et al. 2002[13]; Xu et al. 2010b[14]). Healthcare infrastructure is mostly urban, and healthcare services are mostly urban amenities. The development of health infrastructure is strongly linked to the overall urban development (Gakidou et al. 2010; Xu et al. 2010a; Kabawata et al. 2002; Saksena et al 2010; Missoni, Solimano 2010). With healthcare being financed from many sources, an important feature of the system is the optimal, mutual complementarity of particular sources (modalities) of financing, i.e. they should have as separate domains of application, as possible, without overlapping (Le Gargasson, Salome 2010[15]). Efficiency of healthcare spending is highly idiosyncratic among countries. There are many cases of national healthcare systems, which, with relatively few financial means, achieve much better results, whilst, in the same time, many high – income countries use their healthcare financing in clearly inefficient ways (Hakkinen, Joumard 2007[16]; Stenberg et al. 2010[17]).

There seems to be a curvilinear correlation between healthcare spending per capita, and life expectancy. That correlation translates into a remarkably high elasticity of life expectancy to healthcare expenditure per capita, in countries with low healthcare spending, and a quickly declining elasticity, as expenditures per capita get higher. Countries, which produce remarkably higher health output for the money spent, are not distinctive by their strictly spoken efficiency in healthcare, but rather by the universal coverage and accessibility of their healthcare systems (Evans et al. 2001[18]; Chisholm, Evans 2010[19]).

The trend of change in healthcare systems, observed in the world during the past decade, in connection to the line of research that dominates the WHO discourse, ask for a general answer to the following question: to what extent the long-run development of national healthcare systems, and the associated financial changes, are predictable? Are there any established patterns of change? This general question regards both marginal efficiency, and systemic idiosyncrasy. Firstly, the WHO research focusing mostly on cross-sectional comparison,

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[19] Chisholm, D., Evans D.,B., 2010, Improving health system efficiency as a means of moving towards universal coverage, World Health Report (2010) Background Paper, 28, World Health Organisation

it begs for a more dynamic study, in the sense of links between marginal changes. In other words, given the current, cross-sectional image of various healthcare systems in the world, what factors determine the optimal usage of each additional million of dollars, fuelling the healthcare funds? Secondly, to what extent national healthcare systems are really idiosyncratic? The WHO discourse suggests that the degree of idiosyncrasy is, indeed, very high, and that any transposition of healthcare institutions from one country to another is utmost uncertain as for the outcomes obtained. These two issues refer to two streams of institutional economics. Firstly, as contracts are an important aspect of healthcare systems, the issue of transaction costs, put in a broader context of the new institutionalism, is an important theoretical asset. Secondly, as institutional idiosyncrasy is concerned, the reference to old institutional school seems quite obvious. Thus, it is to assume that the system of financing healthcare is composed of imperfect contracts. As these contracts are drawn and implemented, opportunistic behaviour of social agents, combined with the noticeable specificity of assets, and bounded rationality, create substantial costs of managing the whole system, in the lines of the Williamson's theory (Williamson 1975[20], 1985[21], 1991[22]). Opportunistic behaviour seems, by far, to be most important, and the most scalable factor of transaction costs in national healthcare systems. Corruption and nepotism connected to public procurement in healthcare are a good illustration to that. Getting from that new institutional, theoretical context to the old institutionalism, the most important issue to consider seems to be institutional stability of national healthcare systems. The old institutionalism points out that institutional systems form gradually, with the voting of legal rules being just the first step in a process, in which economic agents gradually develop typical patterns of behaviour, these patterns shaping, in turn, the legal rules (see for example: Hodgson 2000[23], 2006[24]; Searle 1995[25], 2005; Joas 1996[26]; Twomey 1998[27]; Kilpinen 2000[28]). It is both an empirical observation and a theoretical development of the old institutionalism that countries with relatively inefficient institutions cannot just switch to more efficient ones, the process of such change being progressive and imperfectly efficient in itself (ex Aoki 2007[29]). Still in the line of the old institutionalism, it is to keep in mind that institution forming takes

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[28] Kilpinen, E., 2000, The Enormous Fly-Wheel of Society: Pragmatism's Habitual Conception of Action and Social Theory, Helsinki: University of Helsinki
[29] Aoki, M., 2007, Endogenizing Institutions and Institutional Changes, Stanford University, revised version of an invited lecture at the 2005World Congress of the International Economic Association in Morocco

place in polycentric social systems, with the degree of decentralisation being a very important factor of efficiency (see for example: Ostrom 2010[30]; Agraval, Gibson 2001[31]; Schlager, Ostrom 1992[32]).

2. The model

Consistently with the literature, particularly in accordance with the previously cited Chisholm and Evans's research (Chisholm, Evans 2010), it is to assume that any given national healthcare system displays a specific quality of healthcare, namely β_H, possible to estimate as the average life expectancy at birth, and a specific ratio β_H/F_H. The latter reflects the quality of healthcare obtained with one unit of healthcare financing, with F_H standing for total healthcare expenditures per capita; β_H/F_H is heterogeneous among countries. If $d\beta_H$ and dF_H stand, respectively, for marginal quality of healthcare, and marginal healthcare expenditures, the ratio $d\beta_H/dF_H$ represents the dynamic elasticity of healthcare quality to healthcare expenses, i.e. the marginal healthcare quality obtained with marginal healthcare expenditures. The present model focuses on the $d\beta_H/dF_H$ dynamic elasticity as the core aspect of national healthcare systems' efficiency.

For a given population of 'N' patients, there is a given set of 'G' theoretically available healthcare goods (drugs included), defined on the grounds of the currently best, internationally recognized, medical practice. Each healthcare good provides specific utility, which is assessed, among others, on the grounds of the possible complementarity, and substitution with other healthcare goods. For example, physiotherapy may be, to some extent, the substitute of surgery, each of them being complementary with a subset of drugs. Each patient 'i' needs, objectively, a subset of healthcare goods, being the integral of 'G', each healthcare good 'j' supposed to be delivered in the expected quantity $eQ_{i,j}$, at the expected price $eP_{i,j}$. The aggregate demand D_H for healthcare is the sum of those individual, bi-dimensional integrals, as shown in equation (1).

$$D_H = \sum_{i=1}^{N} \left(\iint_{j=1}^{G} eQ_{i,j} eP_{i,j} \right) \qquad (1)$$

The assumption of objective needs, in defining the demand for healthcare, is very important. Said demand is not grounded in what patients want, but in what they need, according to the best current medical practice. Equation (1) deals with demand for healthcare strictly spoken, i.e. with goods that are required to take care of the patient's health as such. Of course, it does not exclude the existence of all kinds of medical "caprices", like unnecessary

[30] Ostrom, E., 2010, Beyond Markets and States: Polycentric Governance of Complex Economic Systems, American Economic Review, 100, June 2010, pp. 1 - 33
[31] Agrawal, A., Gibson, C., ed. 2001., Communities and the Environment: Ethnicity, Gender, and the State in Community-Based Conservation. New Brunswick, NJ: Rutgers University Press
[32] Schlager, E., Ostrom, E.,. 1992, Property-Rights Regimes and Natural Resources: A Conceptual Analysis, Land Economics, 68(3): 249–62

plastic surgeries, or weight loss clinics. These kinds of medical (or rather vaguely medical) services are not part of the healthcare system, according to the present model, and are not included in the definition of demand for healthcare goods. It is also to note that demand for healthcare, as defined in equation (1), is a kind of technological frontier for any given national healthcare system, i.e. the most advanced basket of healthcare goods possible. Against that technological frontier, the actual supply S_H of healthcare goods is projected. Healthcare goods that each patient '*i*' receives, are the integral of '*K*', each healthcare service '*j*' delivered in the actual amount $Q_{i,j}$, at the actual price $P_{i,j}$, as in equation (2).

$$S_H = \sum_{i=1}^{N} \left(\iint_{j=1}^{G} Q_{i,j} P_{i,j} \right) \qquad (2)$$

The quality of healthcare has two levels, namely individual, and collective. Individually, for the given patient '*i*', the quality of healthcare β_i is assessed on the grounds of the correspondence between the expected, and the actually supplied quantities and prices of healthcare goods. That individual quality of healthcare depends on the actual accessibility of the state-of-the-art healthcare goods to the given patient. Accessibility, in turn, is equivalent to the probability that the given patient receives exactly what they need, in terms of healthcare goods. That probability is Pareto-distributed, as in equation (3), according to the patient overall social status '*x*', the latter being measured as a fraction of the highest social status observed in the given population of patients[33].

$$\beta_i(x) = \iint_{j=1}^{G} eQ_{i,j} eP_{i,j} \times \begin{cases} 1 - \left(\frac{x_m}{x}\right)^{\alpha} \\ 0 \end{cases} \qquad (3)$$

There is a threshold 'x_m' of social status, below which the given patient does not have actual access to healthcare goods. The parameter 'α' represents the elasticity of β_i to social status, and is, in fact, the opposite of universal coverage in healthcare. Both x_m and α are country – specific. It is to note that according to equation (3), the individual quality of healthcare is, in geometrical terms, the volume of an irregular polyhedron. That polyhedron may take various shapes, but what counts is its volume. In practice, it means that individual quality of healthcare may be improved through compensating, for example, relatively high prices of some healthcare goods with more affordable prices of other healthcare goods. At the collective level, the overall quality β_H of healthcare in the given country depends on the distribution of social status across the population, and on the parameters of the equation (3), namely x_m and α, which is formalised in equation (4).

$$\beta_H = \int_{i=1,x>0}^{N} \beta_i(x) = \int_{i=1,x>0}^{N} \left\{ \iint_{j=1}^{G} eQ_{i,j} eP_{i,j} \times \begin{cases} 1 - \left(\frac{x_m}{x}\right)^{\alpha} \\ 0 \end{cases} \right\} \qquad (4)$$

[33] It is assumed that in most countries there is a minority of the most privileged patients, who can always have access to the best possible medical assistance, whatever the national average is.

Equation (4) bears important assumptions for further consideration. Firstly, it allows assuming that the relative performance of the given national healthcare system depends, partly, on exogenous factors, namely on expected quantities, and expected prices of healthcare goods, as well as on the social structure in place. They form the context, in which the given level of healthcare expenditures assures a certain accessibility of healthcare, with the latter being defined with two parameters, namely "1/α", and x_m. Equation (4) explains, thus, why national healthcare systems are, as a rule, imperfectly efficient in translating healthcare expenditures into life expectancy. It also points at some detailed aspects of said efficiency, especially at the correspondence between the general concept of healthcare quality, and the empirically used variable of life expectancy. Life expectancy at birth mostly depends, besides the obvious genetic, and environmental factor, on prenatal medical assistance, as well as on the supply of paediatric healthcare goods: vaccination, current medical assistance etc. The actual utility of these healthcare goods greatly depends on their universal accessibility. For example, vaccination is efficient at the social scale when applied to the great majority of the population; vaccinating just the wealthiest 20% is pointless as for life expectancy. Thus, equation (4) provides strong theoretical support to the thesis that average life expectancy at birth is a robust, empirical estimation of healthcare quality.

Considering a function $\beta_H(F_H)$, in the lines of the previously cited Chisholm and Evans's research (Chisholm, Evans 2010), one has to imagine a system, in which the total stream of healthcare financing comes as a factor of healthcare goods' accessibility. Such a system is redistributive in essence, i.e. it has to flatten the Pareto curve, and to drive its lower extremity down, by minimizing α and x_m. However, besides pure redistribution, the system has to take into account the technological frontier of medical sciences, or, in other words, the demand for healthcare goods. The crucial issue, for maximising efficiency $\beta_H(F_H)$, is to direct the stream of financing to such groups of patients, where the gap between the objectively defined demand for healthcare goods, and the individual patients' capacity to afford them is the greatest. In other words, any healthcare system has to combine fire and water, namely redistribution, and targeted expenses.

Should marginal change in healthcare quality be considered, or $d\beta_H$, it has, basically, four different underlying mechanisms. Firstly, technological progress may drive up the integral of demand for healthcare, with the given country's capacity to keep up remaining constant. That mechanism is, *a priori*, common for all countries, although sometimes breakthrough medical research conducted in the given country makes, momentarily, selected advanced therapies more accessible to local population, before these therapies become global in reach. Secondly, economic growth may drive down the gap between the demand for healthcare goods, and the x_m threshold in the given country. In other words, as people become wealthier in comparison to the world's average,

their purchasing power regarding healthcare goods grows accordingly. Thirdly, the social structure may change, toward a more equitable one. Such a change is sometimes incremental, and sometimes of a more breakthrough nature (China is an excellent example of the latter). Finally, other factors held constant, healthcare expenditures from pooled funds might drive down the parameters of the Pareto distribution, namely α and x_m, and so contribute to compress the gap between the demand for healthcare, and the supply of it. That last mechanism is the foundation of any healthcare policy, and the grounds, on which dynamic efficiency of healthcare systems should be assessed.

The shape of the Pareto distribution, underlying β_H, depends on the behaviour of healthcare goods' suppliers, as well as on the behaviour of the healthcare funds' operators. Further on, the model assumes that β_H is the outcome of complex, social interactions, which may be modelled as temporary Harsanyi's games with imperfect information (Harsanyi 1953[34]; 1966[35]; 1967[36]; 1968[37]), and, in the same time, sub-games of a Selten's extensive game with imperfect recall (Selten 1975[38]). The set of players is structured into subsets consistent with the given country's social structure. At any given moment, any given player '*l*' of the healthcare system game plays a mixed Nash's strategy, made of pure Nash's strategies (Nash 1950a[39]; 1950b[40]; 1951[41]; 1953[42]), in which a set of modalities of action is associated, through a pay – off function, with a set of results. The set of results is causally and functionally derived from the set of modalities of action, and that link makes each individual strategy more or less, internally consistent. The game has a Nash's solution, i.e. it reaches dynamic equilibrium, when individual strategies are consistent enough to be predictable[43]. In dynamic equilibrium, every individual strategy is in interaction with the space of the game in the sense that individual strategies of different players mutually shape one another. This, in turn, leads to a certain degree of isomorphism among individual strategies: typical patterns of behaviour arise, as for the actual usage of healthcare financing. The latter, namely the total stream of financing F_H that comes to the healthcare system is a finite set of n_f financial flows (funds). It encompasses both the public, and the private pooled funds, as well as the patients' out-of-pocket payments.

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[42] Nash, J.F., 1953, Two – Person Cooperative Games – Econometrica, vol. 21, issue 1, pp. 128 - 140
[43] According to the Nash's theory, any given social game has a solution only when utilities of all the possible outcomes of the game have definite utilities, known to all the players.

Each financial flow $F_k \ni F_H$ bears specific transaction costs $TC(F_k)$, i.e. it is collected and distributed with bounded rationality, in presence of specific assets, and opportunistic behaviour. That makes F_H internally heterogeneous as for efficiency of financing. Logically, the marginal change dF_H in healthcare expenditures is the sum of marginal changes dF_k in its components. Each marginal change dF_k bears specific transaction costs of change, which include both the previously mentioned costs $TC(F_k)$ of maintaining the financial flow, and the costs of change, resulting from specific, opportunistic behaviour, and bounded rationality regarding the change in question. Consequently, the marginal change dF_H in healthcare expenditure is internally heterogeneous as for efficiency. The current supply of healthcare goods is the difference between gross healthcare expenditures, and the transaction costs of funding. Accordingly, the marginal change dS_H in the supply of healthcare goods is the difference between the marginal change dF_H in healthcare expenditures, and the transaction costs of marginal change in said expenditures $TC(dF_H)$, as in equation (5). In other words, prices and quantities of the actually supplied healthcare goods significantly depend on the transaction costs of financing the healthcare system.

$$dS_H = dF_H - \sum_{k=1}^{n_f} TC(dF_k) \qquad (5)$$

Equation (5) means that the elasticity $d\beta_H/dF_H$ of marginal change in healthcare quality to marginal change in healthcare expenditures depends on the transaction costs linked to the said marginal change in healthcare expenditures. As the present model particularly focuses the dynamics of healthcare systems, transaction costs are particularly interesting in that dynamic perspective. The question is: how does change in financing generate transaction costs? Individual financial flows that make the overall healthcare expenditure F_H do not change at the same pace. For any given pair F_k, $F_{k'}$ of financial flows, marginal change in F_k is not equal to marginal change in $F_{k'}$. Thus, the overall marginal change in healthcare expenditures is always heterogeneous, and always means a structural shift in financing. Such a shift induces new challenges for the players of the healthcare system's game. The risk incurred by any given player temporarily rises; new transaction costs appear, both in negotiation of contracts, and in litigation. If we maintain the assumption that financial flows F_k, composing the total health expenditure F_H, are rigorously heterogeneous in their efficiency and pace of change, it is to assume that the greater is the magnitude of change in healthcare expenditure, the greater is the corresponding structural shift, and, consequently, the greater are the transaction costs of change. Henceforth, the elasticity $d\beta_H/dF_H$ of marginal change in healthcare quality to marginal change in healthcare expenditures is inversely proportional to the magnitude of marginal change in healthcare expenditure. Thus, that inversely proportional relationship is not linear. Moreover, as said transaction costs are not predictable *a priori*, because of the complex nature of social

games, marginal change in healthcare quality is not linearly predictable on the grounds of known marginal change in healthcare expenditures.

It is further assumed, given all the preceding considerations, that elasticity $d\beta_H/dF_H$ is essentially heterogeneous among countries, and that any given country's healthcare system is characterized by its individual, comparative efficiency in using marginal change in healthcare financing to improve healthcare quality, in the lines of the Ricardian comparative advantage. In the given set of countries, the elasticity of marginal change $d\beta_H$ in healthcare quality, to marginal change dF_H in healthcare expenditure is bounded-Pareto-distributed over the marginal change in healthcare expenditure, as in equation (6). Consequently, marginal change $d\beta_H$ in healthcare quality is quasi-bounded-Pareto-distributed over the marginal change in healthcare expenditure, as in equation (7).

$$\frac{d\beta_H}{dF_H} = \frac{\lambda Min^{\lambda} dF_H{}^{-\lambda-1}}{1-\left(\frac{Min}{Max}\right)^{\lambda}} \qquad (6)$$

$$d\beta_H(dF_H) = \frac{\lambda Min^{\lambda} dF_H{}^{-\lambda-1}}{1-\left(\frac{Min}{Max}\right)^{\lambda}} \times \frac{1}{dF_H} = \frac{\lambda Min^{\lambda} dF_H{}^{-\lambda-2}}{1-\left(\frac{Min}{Max}\right)^{\lambda}} \qquad (7)$$

Parameters '*Min*', and '*Max*' mean respectively, the minimal, and the maximal, marginal change in healthcare quality, rationally conceivable for the given healthcare system. The parameter λ is the coefficient of shape in the Pareto distribution; in this case, it is a general coefficient of elasticity.

Assuming Pareto distribution among countries follows twofold logic. Firstly, and consistently with Chisholm and Evans's (Chisholm, Evans 2010) findings, it means that in the global set of national healthcare systems, there are a few very specific cases, which can be called "champions", but the great majority achieves rather a low performance. Secondly, it is a kind of fractal thinking: if within the given country accessibility of healthcare is Pareto-distributed over social status, countries are Pareto-distributed as for their overall performance too.

3. Empirical evidence – validation of the model and additional insight

Empirical research, conducted by the author, had two goals, namely validating the model introduced in the previous chapter, and providing additional insights into the issue of healthcare systems' efficiency. Thus, the model has been considered as a set of hypotheses to validate, and serving for exploration.

For that purpose, econometric analysis had been carried out, accompanied by qualitative case studies of those countries, which seem particularly interesting given their quantitative performance in the lines of the model. In econometric analysis, on the grounds of fata provided by the World Health Organisation (WHO 2011[44]), a set of N = 189 countries has been used, with the exclusion of Zimbabwe, Somalia, and Democratic People's Republic of Korea (fault of reliable data). Firstly, and somehow preliminarily, the author repeated the analysis performed by the previously cited Chisholm and Evans (Chisholm, Evans 2010), namely to test the hypothesis of logarithmic, regression function linking total healthcare expenses per capita, and life expectancy, at the country level, with decreasing, and positive elasticity of life expectancy to expenses. The test was made with the 2008 data (Chisholm and Evans used 2006 data). The OLS regression of life expectancy to the per capita health expenditure, with the 2008 data, gave a logarithmic function of $y = 5{,}3363\ln(x) + 36{,}846$, with $R^2 = 0{,}61936$, and the correlation significant at $\alpha = 0{,}05$. The Graph 1, in Appendix, shows a visualisation very much like that presented by Chisholm and Evans. See also Table 1, in Appendix, for synthetic results of both that step of econometric analysis, and the further ones, discussed below. The results are consistent with those obtained by Chisholm and Evans. The hypothesis of cross sectional, positive and decreasing elasticity of life expectancy to health spending, seems to be quite robust. That preliminary step done, four indexes of marginal change, over 2000 – 2008, computed as the ratio of the 2008 value divided by the 2000 value, have been construed, and attributed to variables to the model, namely:

a) The index of marginal change in life expectancy, attributed, consistently with the literature, to the marginal change in healthcare quality $d\beta_H$. In further discussion of empirical findings that index will be called $d\beta_H$.

b) The index of marginal change in total healthcare expenditures per capita, in US$ PPP, attributed to the marginal change in healthcare expenditures dF_H. In further discussion of empirical findings that index will be called dF_H.

[44] World Health Organisation, 2011, World Health Statistics

c) The indexes of marginal change in, respectively, public, and private healthcare expenditures per capita, in US$ PPP. These two have been considered as sub – streams in the overall financial flow of dF_H, and are called, in further discussion, respectively dF_{pl}, and dF_{pr}.

Those four simple indexes served to compute further, composite two. Firstly, the ratio $d\beta_H/dF_H$ has been computed for each country and is considered, in further discussion, as the elasticity of marginal change in healthcare quality to marginal change in healthcare expenditures. In the lines of the model, this is the principal measure of dynamic (i.e. marginal) efficiency of healthcare systems. Secondly, the difference between dF_{pl}, and dF_{pr} has been computed, and is called, in further discussion, the index of handover from private to public, or $dF_{pr \rightarrow pl} = dF_{pl} - dF_{pr}$. That composite index has been considered, in turn, as a measure of structural change, as in equation (5) of the model. It is to be kept in mind that said index is grounded in values expressed in PPP dollars. Thus, the structural shift may take place not only through changes in nominal expenses, but also though changing prices, consistently with equation (2) of the model. Table 2, in the Appendix, presents the full list of countries studied in econometric analysis with the values of said indexes. The list is sorted according to the value of $d\beta_H/dF_H$, which is viewed by the author as the most important variable of the model.

Regression analysis, using the OLS method, has been run, with $d\beta_H$, and dF_H substituted to their theoretical counterparts in equations (6), and (7) of the model. For both equations, robust empirical regression functions have been obtained, significant at $\alpha = 0{,}001$, with $R^2 = 0{,}99248$ for the equation (6), and $R^2 = 0{,}85708$ for the equation (7). In both cases these levels of accuracy have been reached with $0 < \lambda < 0{,}1$. Additionally, in order to provide indirect evidence to equation (5), the handover index $dF_{pr \rightarrow pl} = dF_{pl} - dF_{pr}$ has been substituted to dF_H in equation (6). The resulting regression function, significant at $\alpha = 0{,}001$, gave an accuracy of $R^2 = 0{,}9679$, with $0 < \lambda < 0{,}1$.

Summing up, econometric analysis has provided robust, empirical proof to the model. The next step was qualitative research, particularly oriented on the general question of transaction costs generated in financing healthcare. Before a more in-depth study of selected cases is introduced, empirical distributions of the two composite indexes, namely that of $d\beta_H/dF_H$ elasticity index, and that of $dF_{pr \rightarrow pl} = dF_{pl} - dF_{pr}$ handover index, are to discuss. On the whole, $d\beta_H/dF_H$ is distributed slightly more tightly than the normal curve, with a mean of 0,63917, a standard deviation $\sigma = 0{,}245060889$, a kurtosis K = 15,85482803, and skewness S = 2,819363487. The rather skimpy tails of that empirical distribution (so the countries beyond one standard deviation distance from the mean) contain, respectively, 20 countries on the left side, 18 on the right, and 152 countries within one standard deviation from the mean. Practically all the developed countries, US included, are in the centre of that

distribution, with moderate elasticity of $d\beta_H$ to dF_H. The nominator of the elasticity index, namely $d\beta_H$, represented by marginal change in life expectancy, is distributed fairly evenly. The mean value of $d\beta_H$ in the left tail of $d\beta_H/dF_H$ is 1,042243942; in the centre, it is 1,039307331, and 1,035508401 in the right tail. On the other hand, the denominator dF_H is distributed fairly less evenly. The mean value in the left tail of $d\beta_H/dF_H$ is 3,219046171, with 1,743269702 in the centre, and 0,961831987. Summing up, and well in the lines of the model, cross – sectional disparity of the $d\beta_H/\mathrm{dF_H}$, elasticity index results mostly from disparities in marginal healthcare expenditures. The right tail countries, so the "champions" of dynamic $d\beta_H/dF_H$ elasticity (Saudi Arabia, Mauritania, El Salvador, Uruguay, Seychelles, United Arab Emirates, Liberia, Haiti, Bolivia, Papua New Guinea, Oman, Paraguay, Brunei Darussalam, Marshall Islands, Nauru, Syrian Arab Republic, Eritrea, Sao Tome and Principe) are mostly small economies, with populations hardly exceeding that of London in UK. It could indicate that dynamic efficiency in using healthcare expenditures strongly depends on the demographically defined size of the given healthcare system. Three categories of countries appear in that right tail of $d\beta_H/dF_H$. Firstly, it is the category of islander republics (Marshall Islands, Nauru, and Sao Tome and Principe), representative for small populations, with healthcare systems strongly oriented on serving tourists. Secondly, Haiti, Eritrea, and Mauritania could be considered as representative for extremely underfinanced healthcare systems, doing extremely well in dynamic terms, although remaining at a very low level of life expectancy. These are cases illustrative for the "ambitious poor" paradigm. On the other hand, countries like El Salvador, Uruguay, Liberia, Bolivia, Papua New Guinea, and Paraguay are representative for developing, and emerging economies, consuming a part of their economic growth for the improvement of healthcare quality.

The previously mentioned $dF_{pr\rightarrow pl}$ handover index, whilst having almost the same explanatory power regarding the distribution of $d\beta_H/\mathrm{dF_H}$, than the strictly spoken marginal change in healthcare expenditures, displays meaningful regularities. In the total set of n = 189 countries, the most frequently encountered pattern of change, to be observed in 113 cases, is that handover from private to public sector, at the detriment of the private i.e. $dF_{pr\rightarrow pl} > 0$, $dF_{pl} > 1$, and $dF_{pr} < 1$. Average elasticity $d\beta_H/dF_H$, in that subset, is of 0,591379669. At the second place, as for frequency, is the pattern of $dF_{pr\rightarrow pl} > 0$, $dF_{pl} > dF_{pr} > 1$, i.e. that of public expenses growing faster than the private ones, both displaying real, marginal increase. This subset encompasses 58 countries, and their average elasticity $d\beta_H/dF_H$ is of 0,601201381. The 19 remaining countries present disparate profiles, possible to group into three patterns of handover, namely:

a) Handover from public to private, decrease in both; very high average $d\beta_H/dF_H$ elasticity ($d\beta_H/dF_H$ = 1,583226356); 3 countries (Paraguay, Nauru, Sao Tome and Principe).

b) Handover from public to private, decrease in public, increase in private; high average $d\beta_H/dF_H$ elasticity ($d\beta_H/dF_H$ = 1,126221206); 10 countries (Côte d'Ivoire, Mauritania, United Arab Emirates, Haiti, Papua New Guinea, Oman, Brunei Darussalam, Marshall Islands, Syrian Arab Republic, Eritrea).

c) Handover from public to private, increase in private greater than in public; moderate average $d\beta_H/dF_H$ elasticity ($d\beta_H/dF_H$ = 0,622367999); 6 countries (Myanmar, Lao People's Democratic Republic, Philippines, Grenada, Turkmenistan, Kenya).

Gradual transfer of healthcare financing from the private sector to the public one seems to be the mainstream of institutional change in national healthcare systems. Studying said national idiosyncrasies should specifically address the issue of "public – private" proportions, and their mutual shift, in the given healthcare system.

A more profound study of institutional arrangements in selected cases, picked at various levels of $d\beta_H/dF_H$ elasticity (Liberia, Eritrea, El Salvador, Uruguay, Colombia, Kenya, Poland, Italy) has been conducted, with its results summarized in the paragraphs that follow.

El Salvador (pop. 6,2 million) belongs to the category of "champions" as for the $d\beta_H/dF_H$ elasticity, with $d\beta_H/dF_H$ = *0,*90314. The growth of healthcare expenditures was quite moderate, namely dF_H = 1,138888889, falling into the first quartile of that indicator. On the other hand, the growth of life expectancy was the median of the whole n = 189 set, namely $d\beta_H$ = 1,02857. As for the structural handover, the country belongs to the prevailing category of healthcare systems switching from private to public expenses, at the detriment of the former ($dF_{pr\rightarrow pl}$ = 0,73612; dF_{pl} = 1,49693; dF_{pr} = 0,76082. Nevertheless, the government expenditure on healthcare fell from 7,7% of the GDP in 2002, to 6,1% in 2008. Hence, the shift from private to public had taken place mostly due to economic growth, rather than real expansion of the public sector. According to a World Bank report dating from 2008 (World Bank 2008[45]), so from the end of the period studied, the Salvadorian government had had good achievements both in stimulating economic growth, and in healing the fiscal situation. Additionally, poverty had had declined and the overall social situation had had improved. A Health Sector Fund was created to improve health coverage, and is funded by excise taxes on cigarettes, beer, alcoholic beverages, and guns. According to the World Bank report on health reforms in Central America (World Bank 2007[46]), a significant cornerstone for Salvadorian health reforms was the Development Strategic Plan launched by the Ministry of Health and Social Action in 2001. It focused on improving the efficiency of public healthcare governance through decentralisation. Departmental management units were replaces with 28 health district units,

[45] World Bank, 2008, International Bank for Reconstruction and Development and International Finance Corporation Progress Report on The Country Assistance Strategy for the Republic of El Salvador, February the 1st

[46] World Bank, 2007, Key Issues in Central America Health Reforms Diagnosis and Strategic Implications (In Two Volumes) Volume II: Main Report, March 8, Human Development Sector Management Unit Latin America and the Caribbean Region, Report No. 36426-LAC

or SIBASI, empowered to organise and staff public healthcare in their respective areas, which included procurement and resource allocation. The SIBASI introduced a system of performance-based contracts with healthcare providers, coupled with a system of community participation mechanisms. In 2005, the Salvadorian government enacted the SIBASI law, according to which the healthcare sector management of each province had been split between the Regional Directorate, and the SIBASI. The former had become a supervising unit, coordinating SIBASI with hospitals. The latter keep their role in assuring primary healthcare at the local scale. That law enacted, the initial autonomy of SIBASI had significantly decreased, shifting most of the actual decisional power back to the ministry. On the whole, the SIBASI seem to have had been a good manner to activate the mutual cooperation between the central governments, and the local ones, in the domain of healthcare.

According to the most recent health profile, published by the WHO about El Salvador, available at www.who.int[47], the Salvadorian healthcare system is characterized, in comparison to the regional (i.e. Americas[48]) average, by:

a) Relatively low income per capita, and low healthcare expenditures per capita
b) Good performance as for children immunisation, and tuberculosis treatment
c) Poor performance as for the density of health workforce per 10 000 inhabitants, and as for the resulting availability of healthcare.

Uruguay (pop. 3,2 million), another South American country among the countries in the right tail of dynamic efficiency, displays an elasticity slightly above that at El Salvador, namely $d\beta_H/dF_H = 0{,}92975$. The growth of healthcare expenditures was even lower than on the previous case (dF_H = 1,089900111), with also a lower growth of life expectancy ($d\beta_H$ = 1,01333). The structural handover was of the same kind than in El Salvador, i.e. a shift from private to public expenses, with the private ones decreasing ($dF_{pr\rightarrow pl}$ = 0,39184; dF_{pl} = 1,25813; dF_{pr} = 0,86629).

During the past decade, Uruguay had been facing a severe economic crisis. Among others, the poverty rate increased from 15.3% in 2001 to 32.1% in 2004. In 2000, curiously enough, Uruguay was close to the world record as for the percentage of GDP spent on healthcare, namely 11,2%, with the major part of that spent by the government (54,6%). In 2008, the proportion to GDP fell slightly to 7,8%, and the share of public expenses grew to 63,1%. Public healthcare sector, just as all the public sector in Urugay, has been struggling with a heavy

[47] Wherever reference is made to www.who.int, it means the latest country profile available at the WHO's website. Most profiles have been last updated in April, 2011.
[48] The "Americas" regional average in WHO statistics encompasses United States and Canada, which drives said average quite high.

burden of debt, mostly due to the strong pressure on physicians' wages, overlapping responsibilities in the institutional structure, and low pressure on efficiency. In comparison to its region, namely the Americas, Uruguay does really fine, above the regional average, according to most WHO criteria, especially as for physicians' density per 10 000 inhabitants (almost twice the regional average) (www.who.int; WHO 2011[49]; World Bank 2005[50]).

Liberia (pop. 3,4 million), an African "champion" in dynamic efficiency of healthcare systems, displays an elasticity of $d\beta_H/dF_H = 0,94957$, with a moderate growth of healthcare expenditures (dF_H = 1,179487179), and a very high, fourth-quartile growth of life expectancy ($d\beta_H$ = 1,12). The structural handover is the typical one, i.e. a shift from private to public expenses, with the private ones decreasing, only in the Liberian case that shift is rather a leap than a walk ($dF_{pr\rightarrow pl}$ = 2,02821; dF_{pl} = 2,5; dF_{pr} = 0,47179). Liberia was a country rising from the ashes during the period of observation, i.e. from 2000 to 2008 (World Bank 2007[51]). Two, consecutive civil wars left Liberia with virtually non-existent healthcare systems, and a life expectancy of some 50 years. Any increase in healthcare expenditure meant creating the healthcare system from scrap, starting with giving elementary tools for action to the Ministry of Health and Social Welfare. The institutional change that had taken place in Liberia between 2000 and 2008, and, in the same time, the toughest institutional challenge consisted in passing from a system of emergency relief (so from a bundle of short-term humanitarian projects) to long-term development programmes. According to the current WHO information (www.who.int), in comparison to the African average, Liberia does quite well in children immunisation, antenatal care, birth attendance by skilled personnel, and tuberculosis treatment. However, the general lack of human resources in healthcare remains a great weakness of the national healthcare systems, which can be illustrated by the density of physicians per 10 000 inhabitants, about 23 times lower than the regional average.

Eritrea (pop. 3,5 million), another African country, holding the second place in the overall $d\beta_H/dF_H$ ranking, with $d\beta_H/dF_H$ = 1,86339, is a peculiar case. Whilst displaying quite a good performance in increasing life expectancy ($d\beta_H$ = 1,08197), Eritrea actually decreased its overall healthcare expenditure per capita (dF_H = 0,580645161), and shifted its healthcare system from public to private, with the private sector growing at the expense of the public ($dF_{pr\rightarrow pl}$ = -0,55538; dF_{pl} = 0,53333; dF_{pr} = 1,08871). Eritrea went against the mainstream of structural change in the world, and did it with some success, so to say. However, that change took place in specific conditions: Eritrea has been shrinking demographically: from 4,1 million people in 2002, the population

[49] World Health Organisation, 2011, World Health Statistics
[50] World Bank, 2005, International Bank For Reconstruction and Development, Country Assistance Strategy for The Oriental Republic of Uruguay, for The Period FY05 – FY10, May the 10th, Report No. 31804-UY
[51] World Bank, 2007, Health Systems Reconstruction in Liberia, Project Information Document

descended to 3,45 million in 2007. According to the World Bank (World Bank 2004[52]), the Eritrean government made healthcare an absolute priority, which took place in an environment strongly marked by communicable and preventable diseases, HIV among them. At the beginning of the period studied, i.e. in 2000, some 70% of the population were reported to have access to primary healthcare at within 10 km from their homes. According to the WHO latest brief (www.who.int), Eritrea has successfully dealt with all the major communicable diseases (Poliomyelitis, Measles, Diphtheria, Tetanus, and Whooping Cough). Compared to the regional, African average, Eritrea does exceptionally well as for children immunisation, but quite poorly as for medical assistance to women (i.e. contraceptive prevalence, and antenatal care), and very poorly as for the density of physicians per 10 000 inhabitants (22% of the regional average). The quality of domestic, medical labour force is, by the way, another issue: in 1999, 45% of physicians employed by the Ministry of Health were expatriates. The observed expansion of the private healthcare sector in Eritrea seems to result from two factors (World Bank 2004). Firstly, Eritrean physicians tend to create for themselves a kind of "mirror" jobs in the private sector, in order to increase their wages. Secondly, expansion of the private sector in healthcare seems to correspond to the quick increase in the variety of drugs available in the Eritrean market, with the resulting increase in sales of medicines financed partly or totally out of the patient's own pocket.

Colombia (pop. 43,9 million) belongs to the category of average performance in terms of $d\beta_H/dF_H$ elasticity, displaying an important increase in healthcare expenditures per capita, and a reasonably good improvement of life expectancy ($d\beta_H/dF_H$ = 0,76924; $d\beta_H$ = 1,04110; dF_H = 1,353403141). The structural change is typical, i.e. there is a shift from private to public in healthcare financing, private expenses decreasing ($dF_{pr\rightarrow pl}$ = 0,44093; dF_{pl} = 1,40453; dF_{pr} = 0,96360). According to the World Bank (World Bank 2011[53]), and to the WHO (www.who.int), Colombia has achieved quite a good progress in healthcare quality, assuring a reasonably good level of healthcare, with two, particularly visible weaknesses of its healthcare system. Firstly, said system seems to be overgrown in bureaucratic terms, with many institutions and programmes overlapping in competences and targets, and a relatively low real pressure on efficiency. Secondly, environmental risk factors are a major issue, especially at the outskirts of big cities.

Kenya (pop. 37,2 million), close to Colombia in the dynamic efficiency ranking ($d\beta_H/dF_H$ = 0,79125), displays a good performance in marginal life expectancy ($d\beta_H$ = 1,11111), and an important growth of healthcare expenditures per capita (dF_H = 1,404255319). Kenya is also one of the rare countries, where the structural shift

[52] World Bank, 2004, The Health Sector in Eritrea, A World Bank Country Study, Report no. 29793
[53] World Bank, 2011, International Bank for Reconstruction and Development and International Finance Corporation, Country Patrnership Strategy for The Republic of Colombia, for The Period FY2012 – 2016, Report No. 60620 - CO

over 2000 – 2008 went from public to private, with both sectors growing ($dF_{pr \rightarrow pl}$ = -0,08587; dF_{pl} = 1,14286; dF_{pr} = 1,22872). Reports published by both the World Bank, and the WHO (www.who.int ; World Bank 2010[54]) suggest that over 2000 – 2008 Kenya went through turbulent changes. Since 1993 until 2003, the country had gone definitely down as for health indicators, between 2003 and 2007, it was a slow recovery, and the period of 2007 – 2008 meant another deterioration. The Ministry of Health is strongly marked by corruption and nepotism, which makes the overall reliability and accountability of the public healthcare system, still dominant, very problematic. Governance seems to be the biggest Kenyan problem in healthcare, which has a negative impact on the efficiency of the healthcare infrastructure, otherwise quite good in comparison to the regional average.

The two case studies that follow, namely Italy, and Poland are those of European countries, falling into the centre of the $d\beta_H/dF_H$ distribution, within one standard deviation from average. Italy (pop. 58,8 million), the best of the three as for the $d\beta_H/dF_H$ elasticity, is close to Colombia as for the overall dynamics ($d\beta_H/dF_H$ = 0,75506; $d\beta_H$ = 1,03797; dF_H = 1,374697043), and presents the same pattern of structural change, healthcare expenditures shifting from private to public, private expenses decreasing ($dF_{pr \rightarrow pl}$ = 0,49618; dF_{pl} = 1,44652; dF_{pr} = 0,95035). The WHO data (www.who.int) suggests that the undeniable growth of healthcare expenses per capita in Italy did not have any significant influence upon the main factors of life expectancy, like, for example children mortality and children immunisation. On the other hand, Italy has a very dense medical infrastructure, much denser that the European, regional average. Healthcare expenditures, having had climbed from 7,9% of the GDP in 1990

Poland (pop. 38 million), whilst also in the centre of the $d\beta_H/dF_H$ empirical distribution, displays a much poorer performance, especially marked by a huge leap in healthcare expenditure ($d\beta_H/dF_H$ = 0,47190; $d\beta_H$ = 1,02703; dF_H = 2,176369863). Structural change in Poland is also that of healthcare expenses shifting from private to public, the shift being quite significant, and private expenses still growing, however ($dF_{pr \rightarrow pl}$ = 1,05303; dF_{pl} = 2,09291; dF_{pr} = 1,03988).

Case studies allow formulating some general observations. Firstly, size matters for efficiency, and its influence is inversely proportional. The bigger is the given country, the less chances it has to be highly efficient in transmuting marginal healthcare expenses into marginal healthcare quality. Estimating the issue quite prudently, some 5 million people seem to be the critical size for a healthcare system, as for its efficiency. Beyond that, decentralisation becomes an imperative, and that is the second general observation: decentralisation matters. The more decentralised in the healthcare system, the better is its dynamic performance. As in has been already pointed out, small healthcare systems seem to be more manageable than the big ones. Thirdly, the structural shift

[54] World Bank, 2010, Project Appraisal Document on a Proposed Credit […] to The Republic of Kenya for A Health Sector Support Project, Report No. 53988-KE

$dF_{pr \rightarrow pl}$, whilst being inversely proportional to the $d\beta_H/dF_H$, consistently with the model, plays various roles, depending on its underlying processes. In most countries, that structural shift is rather evolutionary, and caused by two, main, clearly counterproductive phenomena: a) the relatively stronger pressure on wages in publicly financed healthcare b) corruption connected to opportunistic behaviour in public procurement. On the other hand, in some "champion" countries as for the $d\beta_H/dF_H$, elasticity (El Salvador, Uruguay, Liberia, Eritrea), that structural shift is connected either to rapid restructuration or rapid reconstruction of the healthcare system. Such "revolutionary" processes seem to be very productive possibly because they allow neither of the two previously mentioned counterproductive mechanisms. Not every systemic restructuration conveys so high an efficiency. The case of Poland is illustrative for that: between 2000 and 2008 the national healthcare system went through a profound restructuration, and decentralisation, performance – based contracts included, but the bottom line of these changes is a huge increase in public spending on healthcare, and just a moderate increase in healthcare quality. Most obviously, Polish reforms were just an institutionalisation of the otherwise significant pressure on wages in the healthcare sector, and an opportunity to develop new patterns of opportunistic behaviour in public procurement.

The issue of "revolutionary" changes introduces another question, namely that of sustainability. Countries with the highest $d\beta_H/dF_H$ derive their good performance mostly from changes, which are not sustainable on the long run. As decentralisation comes, no government can decentralise forever. Decentralisation has to stop at a certain level. The Salvadorian case shows that, the political context taken into account, decentralisation can stop, and even reverse, quite quickly. Similarly, the Uruguayan case of expenditure rationalisation calls for commenting that you cannot rationalise infinitely: it is a process that has to stop at a certain point. The African "champion" cases, namely Liberia and Eritrea, are representative for a specific type of institutional change. It is the passage from separate, short – term project of humanitarian aid, to institutionally established systems, which, in both cases, has brought straightforwardly a leap, in terms of the $d\beta_H/dF_H$ efficiency. The same kind of remark is to make, as for sustainability: you cannot establish forever. Once the basic institutional framework of the system is in place, the high marginal efficiency resulting from the process of establishing is gone.

Case studies also seem to prove that the pattern of highly efficient, institutional changes in national healthcare systems is independent from the level of wealth. The four "champion" cases studied display great disparities in terms of income per capita, the mechanism of achieving a good $d\beta_H/dF_H$ result worked quite similarly, though.

As observations from case studies are compared to econometric findings, a paradox arises. On one hand, its has been robustly proven that the greater is the magnitude of change in healthcare expenditure, and the greater is the

corresponding structural shift in financing, the greater are the transaction costs of change, and, henceforth, the lower is the elasticity $d\beta_H/dF_H$ of marginal change in healthcare quality to marginal change in healthcare expenditures. On the other hand, qualitative insight into individual cases of national healthcare systems brought some of a contradiction: quick, and profound institutional changes are much more efficient than incremental ones. The former generate efficiency gains, the latter seem to generate mostly costs. The paradox seems to have a twofold explanation. The Pareto distribution essentially serves to part the "champions" of the given social system from the "average performers". An underlying assumption, present, by the way, in Pareto's "Cours d'economie politique" is that the "champions" are highly idiosyncratic in comparison to the rest of the population. Countries grouped in the centre, and in the left tail of the $d\beta_H/dF_H$ empirical distribution, are mostly representative for incremental growth of healthcare expenditures; even institutional reforms, to notice in many cases, prove to be quite superficial. That's the general rule of the model: growth of expenses is mostly unproductive. Conversely, the "champion" countries from the right tail of the $d\beta_H/dF_H$ empirical distribution are representative for profound institutional reforms, where deep structural shift in expenses did not cause a significant increase of the latter, and, moreover, brought significant gain in healthcare quality.

4. Conclusion

The research introduced in the present paper provided additional, robust evidence to some of the findings contained in the World Health Organisation report about the financing of healthcare systems (WHO 2010[55]). It also brought significant, further insights into the matter of efficiency in national healthcare systems. Firstly, it has been robustly proven that the dynamic, comparative efficiency of national healthcare systems is strongly linked to the magnitude, and to the underlying mechanism of marginal changes in healthcare expenditures per capita. In the great majority of countries reporting to the WHO, healthcare expenditures tend to grow significantly, especially in the public sector, without real correspondence to the growth of healthcare quality. Tested with the model introduced in the present paper, most institutional reforms in the healthcare sector, declared by many countries, from the sample studied, reveal to be superficial, without real outcomes in terms of efficiency. Moreover, most national healthcare systems seem to be essentially Keynesian, with the quality of healthcare considered as actually unobservable, and the supply of healthcare goods being put to equality with the infrastructure in hand. Furthermore, especially in big countries, that Keynesian trait seems to bring a perverse kind of the Keynes's "multiplier effect": the expected value of public procurement for healthcare goods gives

[55] WHO, Health Systems Financing. The path to universal coverage, World Health Report, 2010

incentives to invest more in infrastructure, which generates, eventually, further increase in public contracts, healthcare quality being still of secondary importance in the whole process. Some clearly separate cases emerge, among countries displaying the highest, dynamic efficiency in transforming marginal healthcare expenditures into marginal healthcare quality. They are small economies, displaying real, deep institutional changes, combining decentralisation with a profound review of contractual patterns. There, structural shifts in healthcare financing really seem to work. Unfortunately, such highly efficient patterns of institutional change in national healthcare systems are essentially not sustainable, as they are grounded in processes clearly limited in time.

At this point, it is time to argue openly with the authors of the previously cited WHO report about healthcare financing. The main thesis of the report, namely that significant shift of healthcare expenses towards public, pooled funds, seems to be quite doubtful. Systematic changes of that kind are counterproductive: they bring more in terms of wages for healthcare personnel, than in terms of patients' life expectancy. Moreover, most of the so-called "reforms", reported by the WHO in many countries, are not real reforms; they consist in an otherwise logical accumulation of capital around the existing healthcare infrastructure, according to the Keynesian paradigm. So comes the issue of idiosyncrasy among national healthcare systems. In a general rule, and once more contrarily to the WHO theses, national healthcare systems are not as idiosyncratic, as they maybe would like to appear. Their dynamic efficiency seems to obey to quite universal rules, with well observable causalities. The few "champions" of efficiency are exceptional, indeed, in their achievements, but they are not idiosyncratic as such. In other words, both the excellent, and the poor performance in the set of countries studies are possible to explain on the grounds of a common set of hypotheses, contained in the model. That, in turn, is an opening for research on the link between technological progress, and institutional change. Institutions that make national healthcare systems are strongly connected to the current state-of-the-art, internationally recognised medical practice. Putting it plainly, there are no thirty-six ways to run a system of emergency medical help, or a system of children immunisation. There are internationally recognised standards for it, and they seem to be quite an important factor of institutional convergence among national healthcare systems.

Getting to an even broader theoretical context, the research introduced in the present paper provides robust evidence to all the partisans of fiscal conservatism. Healthcare is a schoolbook-like example of public good, and its supply proves to be of quite a little efficiency, as financial outlays tend to grow. Institutional changes seem to be much more effective than financial transfers, as drivers of improvement in healthcare quality.

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Appendix

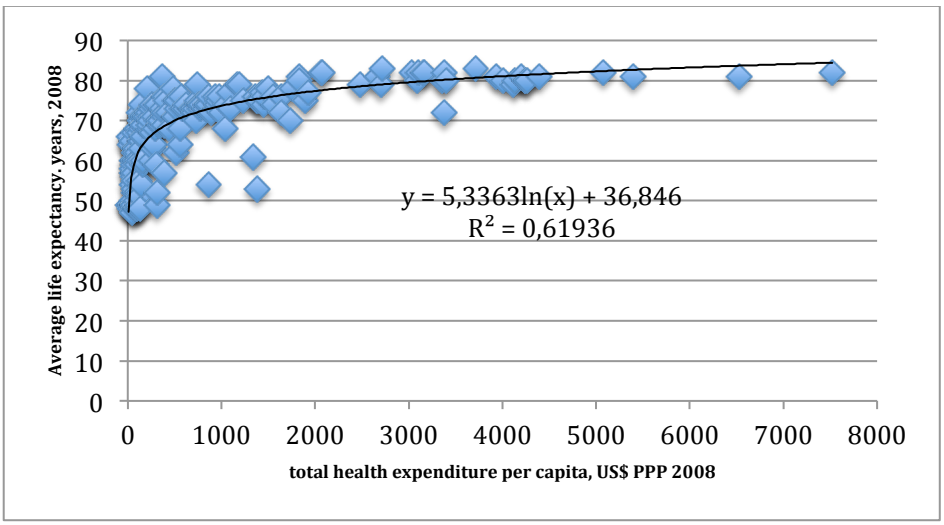
Table 1 – Summary findings of the econometric analysis

x	y=f(x)	Sample size (number of countries studied)	Regression function	Parameters estimation	R^2	Level of significance
Total healthcare expenditures per capita, in US$ PPP	Life expectancy at birth, years	N = 189	Logarithmic, namely $y = \kappa * ln(x) + \theta$	κ = 5,3363 θ = 36,846	R^2 = 0,6194	α = 0,05
Index of marginal change in total healthcare expenditures per capita, in US$ PPP, index = 2008/2000[a]	Index of marginal change in life expectancy, index = 2008/2000[b]	N = 189	Modified bounded Pareto, namely $d\beta_H(dF_H) = \frac{\lambda Min^{\lambda} dF_H{}^{-\lambda-2}}{1-\left(\frac{Min}{Max}\right)^{\lambda}}$, as in equation (7)	*Min* = 0,96429 *Max* = 1,25532 $0 < \lambda < 0,05$	R^2 = 0,8571	α = 0,001
Index of marginal change in total healthcare expenditures per capita, in US$ PPP, index = 2008/2000	Elasticity of marginal change in life expectancy to marginal change in total health expenditures per capita[c]	N= 189	Bounded Pareto, namely $\frac{d\beta_H}{dF_H} = \frac{\lambda Min^{\lambda} dF_H{}^{-\lambda-1}}{1-\left(\frac{Min}{Max}\right)^{\lambda}}$, as in equation (6)	*Min* = 0,20601 *Max* = 2,38384 $0 < \lambda < 0,05$	R^2 = 0,9925	α = 0,001
Index of handover from private to public [d]	Elasticity of marginal change in life expectancy to marginal change in total health expenditures per capita	N= 189	Bounded Pareto, namely $\frac{d\beta_H}{dF_H} = \frac{\lambda Min^{\lambda} dF_H{}^{-\lambda-1}}{1-\left(\frac{Min}{Max}\right)^{\lambda}}$, as in equation (6)[e]	*Min* = 0,20601 *Max* = 2,38384 $0 < \lambda < 0,05$	R^2 = 0,9679	α = 0,001

Source: author's

(a) i.e. healthcare expenditures per capita in 2008, divided by healthcare expenditures per capita in 2000
(b) i.e. life expectancy in 2008, divided by life expectancy in 2000
(c) i.e. (b)/(a)
(d) Composite index, computed in two steps. First, indexes of marginal change had been computed for, respectively, public, and private healthcare expenditures, in the same manner that (a), let's call them "(a)public" and "(a)private". Then, the difference: (a)public minus (a)private has been computed, and that difference is (d).
(e) The index of handover from private to public takes, in some cases, negative values, when private expenditures had grown more than the public ones. The Pareto function does not tolerate negative values in input. Thus, for the purposes of the OLS regression, the index of handover has been transformed by increasing each "*x*" by 1,25, which moved the entire set of empirical points to the "+/+" quadrant of the coordinate system.

Graph 1 - Life expectancy at birth (years) as a function of per capita total expenditure on health (PPP US$), data for 2009.



Source: author's

Table 2 – Indicators used for evaluating healthcare systems in the set of n = 189 countries.

Country	Change in government H_exp per capita [index 2008/2000]	Change in private H_exp per capita [index 2008/2000]	Index of handover from private to public	Change in health exp per capita [index 2008/2000]	Change in life expectancy [index = 2008/2000]	Elasticity of marginal life expectancy to marginal health expenditure
(i)	*(ii)*	*(iii)*	*(iv) = (ii) – (iii)*	*(v)*	*(vi)*	*(vii) = (vi)/(v)*
Equatorial Guinea	7,70	0,64	7,05	4,95	1,02	0,21
Azerbaijan	4,00	0,99	3,01	3,95	1,06	0,27
Sudan	4,45	0,85	3,61	3,77	1,02	0,27
Republic of Moldova	3,45	1,04	2,40	3,60	1,01	0,28
Afghanistan	12,00	0,30	11,70	3,56	1,04	0,29
Rwanda	4,90	0,87	4,03	4,25	1,26	0,30
Georgia	5,36	0,57	4,79	3,05	1,00	0,33
Cuba	3,20	0,95	2,25	3,04	1,01	0,33
Angola	3,60	0,94	2,66	3,39	1,13	0,33
Iraq	6,82	0,42	6,39	2,89	0,97	0,34
Bosnia and Herzegovina	3,03	0,99	2,04	2,99	1,03	0,34
Niue	2,88	0,99	1,89	2,85	1,00	0,35
Maldives	4,16	0,76	3,40	3,18	1,12	0,35
Ukraine	2,98	0,94	2,04	2,79	1,00	0,36
Romania	3,30	0,86	2,44	2,83	1,03	0,36
Serbia	2,46	1,12	1,34	2,77	1,03	0,37
Viet Nam	3,35	0,79	2,56	2,64	1,03	0,39
Montenegro	2,53	1,03	1,49	2,61	1,01	0,39
Russian Federation	2,86	0,93	1,93	2,67	1,05	0,39
Bulgaria	2,54	1,03	1,51	2,61	1,03	0,39
Slovakia	2,02	1,27	0,75	2,55	1,03	0,40
Latvia	2,77	0,91	1,87	2,51	1,01	0,40

Country	Change in government H_exp per capita [index 2008/2000]	Change in private H_exp per capita [index 2008/2000]	Index of handover from private to public	Change in health exp per capita [index 2008/2000]	Change in life expectancy [index = 2008/2000]	Elasticity of marginal life expectancy to marginal health expenditure
(i)	*(ii)*	*(iii)*	*(iv) = (ii) – (iii)*	*(v)*	*(vi)*	*(vii) = (vi)/(v)*
Democratic Republic of the Congo	13,00	0,20	12,80	2,56	1,04	0,41
Estonia	2,54	1,00	1,54	2,53	1,06	0,42
China	3,07	0,81	2,27	2,48	1,04	0,42
Burundi	3,33	0,75	2,58	2,50	1,06	0,43
Lithuania	2,30	1,02	1,28	2,35	1,01	0,43
Ecuador	2,97	0,79	2,17	2,35	1,03	0,44
Algeria	2,76	0,85	1,91	2,36	1,04	0,44
Uganda	1,67	1,49	0,17	2,49	1,11	0,44
Kazakhstan	2,62	0,87	1,75	2,28	1,02	0,45
Costa Rica	2,00	1,15	0,85	2,30	1,03	0,45
Mauritius	1,52	1,51	0,00	2,30	1,03	0,45
Cambodia	2,55	0,91	1,64	2,31	1,03	0,45
Tajikistan	3,25	0,73	2,52	2,38	1,06	0,45
Botswana	3,29	0,80	2,49	2,63	1,20	0,46
Chad	2,53	0,85	1,68	2,15	0,98	0,46
Myanmar	1,00	2,25	-1,25	2,25	1,03	0,46
Poland	2,09	1,04	1,05	2,18	1,03	0,47
Guyana	2,23	0,96	1,26	2,15	1,02	0,47
Niger	2,56	0,92	1,63	2,35	1,12	0,48
Belarus	2,01	1,06	0,95	2,13	1,01	0,48
Albania	2,38	0,91	1,47	2,17	1,04	0,48
Republic of Korea	2,60	0,84	1,75	2,19	1,05	0,48
Ireland	2,22	0,98	1,24	2,18	1,05	0,48
Morocco	2,71	0,80	1,91	2,16	1,06	0,49
Kiribati	1,89	1,11	0,78	2,10	1,03	0,49
Greece	2,11	0,99	1,12	2,08	1,03	0,49
Malaysia	1,72	1,19	0,54	2,04	1,01	0,50
Kyrgyzstan	2,22	0,91	1,31	2,02	1,02	0,50
Burkina Faso	3,06	0,65	2,41	2,00	1,02	0,51
Indonesia	2,88	0,67	2,21	1,94	1,00	0,52
Thailand	2,65	0,75	1,90	1,99	1,03	0,52
Iran (Islamic Republic of)	2,13	0,98	1,15	2,09	1,09	0,52
Nicaragua	1,99	0,98	1,01	1,95	1,01	0,52
Micronesia (Federated States of)	1,89	1,04	0,86	1,96	1,03	0,53
United Republic of Tanzania	3,42	0,60	2,82	2,04	1,08	0,53
Lao People's Democratic Republic	1,15	1,82	-0,67	2,10	1,12	0,53
Bangladesh	1,56	1,29	0,27	2,00	1,07	0,53
Singapore	1,48	1,32	0,17	1,96	1,05	0,54
Spain	1,87	1,03	0,84	1,92	1,04	0,54
Cape Verde	1,88	1,01	0,88	1,89	1,03	0,54
Monaco	1,88	1,00	0,89	1,87	1,03	0,55
Czech Republic	1,65	1,13	0,52	1,86	1,03	0,55
Sri Lanka	1,67	1,11	0,57	1,85	1,03	0,56
Senegal	2,85	0,65	2,20	1,85	1,03	0,56

Country	Change in government H_exp per capita [index 2008/2000]	Change in private H_exp per capita [index 2008/2000]	Index of handover from private to public	Change in health exp per capita [index 2008/2000]	Change in life expectancy [index = 2008/2000]	Elasticity of marginal life expectancy to marginal health expenditure
(i)	*(ii)*	*(iii)*	*(iv) = (ii) – (iii)*	*(v)*	*(vi)*	*(vii) = (vi)/(v)*
Croatia	1,81	1,02	0,80	1,84	1,03	0,56
Saint Lucia	1,79	1,00	0,79	1,79	1,00	0,56
Honduras	1,91	0,96	0,95	1,84	1,03	0,56
Netherlands	2,17	0,84	1,33	1,82	1,04	0,57
Turkey	2,16	0,86	1,30	1,86	1,07	0,58
Finland	1,77	1,01	0,77	1,78	1,03	0,58
Barbados	1,73	1,03	0,69	1,78	1,03	0,58
Nigeria	2,05	0,95	1,10	1,95	1,13	0,58
Congo	1,59	1,15	0,44	1,83	1,06	0,58
Chile	1,50	1,18	0,32	1,77	1,03	0,58
Belize	2,16	0,83	1,33	1,79	1,04	0,58
Hungary	1,72	1,03	0,69	1,76	1,03	0,58
United Kingdom	1,83	0,96	0,87	1,76	1,03	0,58
Lesotho	2,17	0,81	1,37	1,75	1,02	0,58
Armenia	2,76	0,62	2,15	1,71	1,00	0,58
Tunisia	1,73	1,02	0,71	1,75	1,03	0,59
Brazil	1,93	0,92	1,02	1,77	1,04	0,59
Samoa	2,11	0,84	1,27	1,77	1,04	0,59
Norway	1,77	0,97	0,80	1,72	1,03	0,60
Ghana	2,11	0,82	1,29	1,73	1,03	0,60
Solomon Islands	1,74	0,98	0,76	1,72	1,03	0,60
Portugal	1,59	1,08	0,51	1,71	1,03	0,60
Djibouti	1,95	0,88	1,07	1,72	1,03	0,60
India	2,11	0,84	1,27	1,77	1,07	0,60
Panama	1,71	0,98	0,72	1,68	1,01	0,60
Namibia	1,40	1,26	0,14	1,77	1,08	0,61
Ethiopia	1,73	1,07	0,66	1,85	1,13	0,61
Sierra Leone	1,75	1,12	0,63	1,96	1,20	0,61
Jordan	2,14	0,77	1,38	1,65	1,01	0,62
Mexico	1,68	0,99	0,69	1,66	1,03	0,62
Belgium	1,63	1,01	0,62	1,65	1,03	0,62
Antigua and Barbuda	1,65	1,01	0,64	1,65	1,03	0,62
Philippines	1,22	1,34	-0,13	1,63	1,01	0,62
New Zealand	1,69	0,97	0,72	1,65	1,03	0,62
Slovenia	1,55	1,08	0,47	1,67	1,04	0,62
Peru	1,71	0,99	0,72	1,69	1,06	0,62
Cameroon	1,63	0,99	0,64	1,60	1,00	0,62
Andorra	1,76	0,93	0,83	1,63	1,03	0,63
Cyprus	1,64	1,02	0,63	1,67	1,05	0,63
South Africa	1,50	1,02	0,48	1,53	0,96	0,63
Uzbekistan	1,89	0,88	1,01	1,65	1,05	0,63
Bahrain	1,65	0,97	0,69	1,60	1,01	0,63
Saint Vincent and the Grenadines	1,59	1,03	0,55	1,64	1,04	0,64
Sweden	1,46	1,09	0,37	1,59	1,01	0,64
Guatemala	1,45	1,11	0,33	1,61	1,03	0,64
Denmark	1,56	1,03	0,53	1,60	1,03	0,64
Argentina	1,70	0,91	0,79	1,55	1,00	0,64

Country	Change in government H_exp per capita [index 2008/2000]	Change in private H_exp per capita [index 2008/2000]	Index of handover from private to public	Change in health exp per capita [index 2008/2000]	Change in life expectancy [index = 2008/2000]	Elasticity of marginal life expectancy to marginal health expenditure
(i)	*(ii)*	*(iii)*	*(iv) = (ii) – (iii)*	*(v)*	*(vi)*	*(vii) = (vi)/(v)*
Togo	1,31	1,24	0,06	1,63	1,05	0,65
Vanuatu	1,78	0,90	0,88	1,59	1,03	0,65
Dominican Republic	1,61	0,93	0,68	1,50	0,97	0,65
Dominica	1,39	1,10	0,29	1,54	1,00	0,65
Saint Kitts and Nevis	1,53	1,04	0,49	1,59	1,04	0,66
Grenada	1,10	1,40	-0,29	1,54	1,01	0,66
Bhutan	1,66	0,96	0,69	1,59	1,05	0,66
Canada	1,52	1,01	0,50	1,54	1,03	0,67
Timor-Leste	1,94	0,86	1,07	1,67	1,12	0,67
Turkmenistan	1,11	1,37	-0,26	1,51	1,02	0,67
Guinea-Bissau	1,60	0,97	0,63	1,55	1,04	0,67
United States of America	1,69	0,90	0,78	1,52	1,03	0,67
France	1,45	1,05	0,41	1,52	1,03	0,67
Suriname	1,54	1,00	0,53	1,54	1,04	0,68
Mozambique	1,53	0,98	0,54	1,50	1,02	0,68
Yemen	1,26	1,24	0,01	1,56	1,07	0,68
Comoros	1,71	0,88	0,84	1,50	1,03	0,69
Australia	1,45	1,02	0,43	1,48	1,03	0,69
Luxembourg	1,61	0,93	0,67	1,50	1,04	0,69
Madagascar	1,65	0,96	0,69	1,59	1,10	0,69
Switzerland	1,60	0,94	0,66	1,50	1,04	0,70
Kuwait	1,53	0,97	0,56	1,47	1,03	0,70
Germany	1,38	1,07	0,31	1,47	1,03	0,70
Zambia	1,96	0,83	1,13	1,63	1,14	0,70
Venezuela (Bolivarian Republic of)	1,57	0,92	0,64	1,45	1,01	0,70
Nepal	2,27	0,68	1,60	1,53	1,08	0,70
Austria	1,39	1,04	0,35	1,45	1,03	0,71
Malta	1,51	0,96	0,54	1,45	1,03	0,71
Swaziland	1,50	0,96	0,53	1,44	1,02	0,71
Mongolia	1,53	0,99	0,54	1,51	1,08	0,72
Japan	1,42	1,01	0,41	1,43	1,02	0,72
Guinea	1,60	0,91	0,69	1,45	1,04	0,72
Cook Islands	1,49	0,99	0,49	1,48	1,07	0,72
The former Yugoslav Republic of Macedonia	1,68	0,84	0,84	1,42	1,03	0,72
Libyan Arab Jamahiriya	1,72	0,81	0,91	1,40	1,01	0,73
Italy	1,45	0,95	0,50	1,37	1,04	0,76
Egypt	1,45	0,95	0,49	1,38	1,04	0,76
Colombia	1,40	0,96	0,44	1,35	1,04	0,77
Gambia	2,00	0,68	1,32	1,36	1,05	0,77
Gabon	1,39	0,96	0,43	1,33	1,03	0,78
Trinidad and Tobago	2,98	0,44	2,54	1,31	1,01	0,78
Pakistan	2,00	0,66	1,34	1,32	1,03	0,78
Palau	1,27	1,03	0,25	1,31	1,03	0,79
Kenya	1,14	1,23	-0,09	1,40	1,11	0,79

Country	Change in government H_exp per capita [index 2008/2000]	Change in private H_exp per capita [index 2008/2000]	Index of handover from private to public	Change in health exp per capita [index 2008/2000]	Change in life expectancy [index = 2008/2000]	Elasticity of marginal life expectancy to marginal health expenditure
(i)	*(ii)*	*(iii)*	*(iv) = (ii) – (iii)*	*(v)*	*(vi)*	*(vii) = (vi)/(v)*
San Marino	1,28	1,00	0,28	1,29	1,02	0,80
Iceland	1,33	0,96	0,36	1,28	1,03	0,80
Mali	1,88	0,71	1,17	1,33	1,06	0,80
Malawi	1,76	0,77	0,99	1,36	1,09	0,80
Central African Republic	1,30	0,98	0,32	1,28	1,04	0,82
Lebanon	2,01	0,63	1,38	1,27	1,04	0,82
Fiji	1,15	1,06	0,08	1,22	1,01	0,83
Bahamas	1,27	1,00	0,27	1,26	1,06	0,83
Jamaica	1,12	1,04	0,07	1,16	0,99	0,85
Benin	1,45	0,84	0,62	1,22	1,04	0,85
Tuvalu	1,19	1,00	0,19	1,19	1,02	0,85
Israel	1,11	1,09	0,02	1,22	1,04	0,85
Tonga	1,24	0,96	0,28	1,18	1,03	0,87
Qatar	1,35	0,86	0,48	1,16	1,01	0,87
Côte d'Ivoire	0,75	1,54	-0,79	1,16	1,02	0,88
Saudi Arabia	1,09	1,05	0,04	1,14	1,01	0,89
Mauritania	0,87	1,30	-0,43	1,13	1,00	0,89
El Salvador	1,50	0,76	0,74	1,14	1,03	0,90
Uruguay	1,26	0,87	0,39	1,09	1,01	0,93
Seychelles	1,08	1,01	0,07	1,08	1,01	0,94
United Arab Emirates	0,94	1,14	-0,20	1,08	1,01	0,94
Liberia	2,50	0,47	2,03	1,18	1,12	0,95
Haiti	0,88	1,30	-0,42	1,15	1,13	0,98
Bolivia (Plurinational State of)	1,19	0,91	0,28	1,08	1,06	0,99
Papua New Guinea	0,98	1,03	-0,05	1,01	1,03	1,02
Oman	0,90	1,08	-0,19	0,97	1,04	1,08
Paraguay	0,93	0,99	-0,07	0,92	1,00	1,09
Brunei Darussalam	0,90	1,01	-0,11	0,91	1,00	1,10
Marshall Islands	0,84	1,00	-0,17	0,84	1,00	1,19
Nauru	0,85	0,93	-0,08	0,79	1,02	1,28
Syrian Arab Republic	0,76	1,03	-0,27	0,79	1,04	1,32
Eritrea	0,53	1,09	-0,56	0,58	1,08	1,86
Sao Tome and Principe	0,50	0,87	-0,38	0,43	1,03	2,38

Source: author's, on the grounds of data provided by the World Health Organisation (WHO 2011[56])

[56] World Health Organisation, 2011, World Health Statistics