Does good governance improve public health expenditure-health outcomes nexus? New empirical evidence from Africa

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Abstract

The paper aims at re-assessing the public health spending-health outcome nexus in the context of African countries. The paper emphasizes the interaction of governance with public health expenditure and its effects on health outcomes using a panel covering 43 African countries. from 1996 to 2012. We use cross sectional, fixed effects and Generalized Method of Moments (GMM) estimators. We find that health expenditure per capita and public spending have a significant impact on health outcomes. However, the role of governance and the interaction of governance with public health expenditure appear mixed. One explanation is that maybe the public health expenditure and governance indicator may only imperfectly and partially measure the true amount of resources and quality of institution, respectively these two variables are supposed to reflect.

Keys words: Health expenditure; Governance; health outcomes, Panel data.
JEL classification:C23; H51; I15

1- Introduction

Improving social services delivery is central for poverty reduction since making these services available to the majority of the populations, especially for poor, has been recognized as critical to the development processes. The provision of such services can be seen as a key element of a public policy aimed to promote a broad-based economic growth and to raise living standards. With respect to this viewpoint, international organizations encourage governments in developing countries to devote a significant amount of their budget to the provisions of social services in general and health sector in particular. Consequently, many developing countries have prioritized the provision of primary health services, basic education, and access to safe drinking water in their budgetary allocation. For instance, public spending on health as percentage of total health spending increased for Africa (from 44% in 2000 to 47.2% in 2012), relative to that of the world average health spending (from 56.4% in 2000 to 58.9% in 2012 (table 1). Over the same period, public budget share allocated to health in Africa is higher compared to that of South-East Asia and Oriental Mediterranean regions, which recorded an increase of 15.62%. Meanwhile, except South-East Asia region, Africa spends the lowest on health expenditure per capita, however health spending per capita is increasing faster over time. For example, between 2000 and 2012 the percentage increases are 64.64% for Africa against 52.31% for Eastern Mediterranean, 60.71% for Europe and 51.83% for the world average. Total health expenditure as percentage of GDP is higher in Africa than it is in South-east Asia and Eastern Mediterranean but lower than those of Europe and average world (Table 1).

Table 1 : Trend in health expenditure for selected regions.

Regions	Public HE(% total HE)		Public HE (% public budget		HE per capita (current $US)		Private HE (% of GDP)		Public HE (% GDP		HE total (% of GDP)	
	2000	2012	2000	2012	2000	2012	2000	2012	2000	2012	2000	2012
Africa	44.0	47.2	8.1	9.6	35.0	99.0	3.16	3.2	2.43	2.99	5.6	6.2
South-east Asia	32.2	34.7	7.3	7.6	20.0	69.0	2.47	2.34	1.15	1.35	3.6	3.7
Oriental Mediterranean	47.4	48.5	6.9	7.4	93.0	195.0	2.12	2.05	1.97	2.14	4.1	4.2
Europe	73.9	74.4	14.0	14.8	931.0	2370	2.03	2.32	5.86	6.65	7.9	9.0
World	56.4	58.9	13.5	15.1	485.0	1007	3.58	3.74	4.61	5.35	8.2	9.1

Source: WHO (2014)

On other hand, for many developing regions, especially in Africa, it is noticed a poor service delivery outcome compared to other regions. In health sector, African countries experience a heavy burden of diseases and high needs in the access to health care services leading to immense human sufferings, loss of millions of lives and significant economic losses every year (WHO, 2014). Even if health status in Africa has improved over the last two decades, Africa remains an unhealthy continent (Mwabu, 2011). On many indicators of health, Africa lags behind the rest of the world and behind poor countries of south-East and South Asia (table 2). It can be seen that Africa has the worst indicators in the world for general health outcome. For instance, compared to other regions, Africa has the lowest life expectancy at birth and records the highest infant mortality rates and death rates (table 2).

Table 2: Selected health outcome indicators for some regions.

Health outcome	**Africa**		**South-east Asia**		**Oriental Mediterranean**		**Europe**		**World**	
	1990	2012	1990	2012	1990	2012	1990	2012	1990	2012
Life expectancy at birth (years)	50	58	59	67	62	68	72	76	64	70
Infant mortality rate per 1,000 live births	105	63	83	39	76	44	26	10	63	35
Under-five mortality rates per 1,000 live births	173	95	118	50	103	57	32	12	90	48
Death rates	326	298	226	149	196	139	96	80	233	187

Source: WHO (2014)

This trend in health outcome in Africa reflects the inappropriateness of health policies to offset the negative effects of illness. As health expenditure is an important input in health production function (Grossman, 1999), every country undertakes public fund to health care provision, believing this would improve the health of their citizens (Rajkumar and Swaroop, 2008). However, an increase in budgetary allocation to health sector itself is not sufficient to guarantee improvement in health outcomes**.** For example, inappropriate functioning of health care system, bad budget management has been identified as one of the main reason for ineffective public spending in developing countries (World Bank, 1998, 2003). One can argue that as budget formulation and execution are malfunctioning as merely increase in public allocation may not lead to higher health outcomes. Therefore, if the basic principles of governance in health care delivery are not observed, priorities cannot be met and scarce resources are wasted and well-intentioned spend may have no impact on health outcome. This is particular the case of Africa, where Kimenyi (2012) argued that delivery of basic public services including health services can be greatly improved even with the current levels of resources commitments.

Again, most of empirical studies on the relationship between public spending and health care system performance show conflicting results. Some studies indicate that the effect of public spending on health status is not significant (Carrin and Politi , 1995) while other studies report lower or positive effect (Gupta et al., 1999; Gupta et al., 2001; Novignon et al, 2012) throwing some doubt on the conclusiveness of these studies.

Given that unresolved nature of the nexus between public spending-health outcome, the significance of governance comes to mind. Governance can be defined as “the manner in which power is exercised in the management of a country’s economic and social resources for development” (World Bank, 1991). It is well-known that influences development outcome, especially economic growth (Gisselquist 2002). For example, in poorly governed countries, high levels of corruption lead to evasion of taxes that could have been used to finance productive government investment and social expenditures for the poor. High levels of corruption also lead to the diversion of government funds that could have been used for service delivery to the poor (Rajkumar and Swaroop 2008).

Despite the importance of understanding the causal relationship between governance and broader development outcomes, much of the empirical literature has mostly focused on the narrower question of whether good governance leads to higher levels of income (Sen, 2014). Conversely, there is scant literature on the relationship between governance and broader development outcomes such as infant and maternal mortality, life expectancy at birth, year of schooling, etc. The exceptions are Kaufmann et al., (2004), Rajkumaran and Swaroop (2008), Wolf (2007), Hallerod et al. (2013) and Olafsdottir et al. (2011) who confirm the role of good governance in engendering sustainable health care delivery performance. In Africa region, however, many of those previous studies on health spending-health outcome nexus do not account for the impact of governance on this relationship (Akinkugbe and Afeikhena, 1996;Anyanwu and Erhijakpor, 2009; Novignon et al, 2012). To fill the gap, there appears the need to better understand health expenditure-health outcome nexus focusing on how better governance may affect the effectiveness of public health expenditure in Africa. Thus, research questions this paper seeks to answer are: Does greater health expenditure translates to better health outcome in Africa context? Does governance have any effect on the public health expenditure-health outcome nexus in Africa region? Does governance has any income effect on health outcomes?.

The relationship between health outcome and health expenditure is an interesting topic to be studied in Africa for a number of reasons. First, a common feature of all health system from African economies is the shortage of financial resources compared with health needs and this could be currently exacerbated by the economic crisis that has led many Governments to reconsider the level of public spending in the health sector. The scarcity of health system resources implies that there is an urgent need for efficient use of the available resources. Thus, better knowledge of effect of governance on health outcome appears to be necessary. Second, the proportion of budget spent on health in Africa tends to rise. It is, therefore, necessary to investigate the health outcome impact of such a relatively large expenditure. Third, it is of particular interest to investigate the mechanisms through which health spending affects health outcome in order to improve the efficiency of such investment. Fourth, as to Schultz (1999), health is the ultimate indicator of the well-being of a nation; hence the attainment of high stocks of health is an important aspect of development in its own right. Fifth, whether better governance leads to greater health outcomes is particularly relevant in the context of Africa characterized by strong economic growth and weak and dysfunctional governance systems, relative to other regions of the world (Kimenyi, 2012). Sixth, findings from previous studies and this study could be a basis for future policy decision regarding how to improve health service delivery in Africa.

The rest of the paper is organized as follows. Section 2 presents an overview of public health spending and health outcome relationship. Section 3 introduces the empirical methodology, while Section 4 presents data and descriptive statistics. Section 5 discusses the empirical results. Finally, Section 5 offers concluding remarks.

2- Literature review: Public expenditure-health system nexus

According to Musgrove (1996), three main reasons justify Government intervention in health care market: optimal production of public goods, offsetting market failures such as externalities, and subsidizing poor people who cannot finance out-of-pocket or buy private insurance. It can stimulate information distribution, take regulative activities, finance private health services with public funds and, supply health services itself through public facilities and staffs. Musgrove (1999) determines the nine criteria based on economic efficiency (public goods, externalities, catastrophic costs and cost-efficiency), ethical reasons (poverty, vertical equity, horizontal equity and rule of rescue) and political considerations (public demands) related with government intervention to health sector. In these kinds of conditions, public provided health care is probably more efficient than private sector. These types of health services are expected to have considerably important impacts on health outcomes such as life expectancy, infant or child mortality.

On empirical front, the effect of public spending on health outcome is mixed (Hammer and Pritchett, 1998; World bank and IMF, 2005). For instance, using cross-sectional data of 50 developing and transition countries Gupta et al. (1999) find that expenditure allocated to health sector reduces mortality rates for infant and children. They also find that shifting health expenditure toward primary care has a favorable effect on infant and child mortality rates. Also, using a sample of 70 countries Gupta et al (2001) note that the relationship between public health spending and health status of poor is stronger in low income countries than it is in higher income countries. On other hand, Carrin and Politi (1995) argued that poverty and income are critical determinants of health outcomes, but fail to find that public health expenditure has a statistically significant effect on health status. Similarly, Filmer and Pritchett (1997) suggest that cross-country differences in income allow to account for 84% of the variation in infant mortality, with socio-economic variables accounting for 11% and public spending for less than 1/6 of one percent. In contrast, Badani and Ravallion (1997) disaggregate health outcome across rich and poor segments of the population for 35 developing countries for year 1990. Using a random coefficient model, the authors find that public spending has a beneficial impact on health condition of the poor (life expectancy at birth and infant mortality). Furthermore, they observe that those living on less than $2 a day are likely to live 9 years less on average compared to the rest of the population and their children face 53% higher likelihood of dying before their first birth day. Taking into account allocation within health sector, Filmer, Hammer and Pritchett (1998) find a significant effect of government spending on primary health care on infant mortality rate in their cross-sectional analysis. The lower or insignificant impact of public health spending on health outcome does not mean that countries are spending on unproductive activities. One can assume that these studies do not shed light on the true relationship between public health spending and health status. For example, Devarajan et al (1996) note that the negative impact of capital spending on per capita growth may reflect a problem in the link between public spending and service delivery. Pretchett (1996) note that all of the negative or ambivalent findings on public spending could be a reflection of differences in the efficacy of public expenditure. These differences could rise due to corruption, the replacement of private sector effect by public spending. In the same vein, Filmer et al (2000) argue that changes in the price or the availability of government interventions may induce a private supply response that can mitigate any actual impact on health status. If an increase in public spending on health crowds out private sector provision of such service thereby a likely impact of an additional unity of public spending on health status may be marginal. Using data from 47 African countries between 1999 and 2004 and fixed effect model, Anyanwu and Erhijakpor (2009) find that health expenditures have a statistically significant effect on infant mortality and under-five mortality. Akinkugbe and Afeikhena (1996) also provide evidence that the effect of health care expenditure as a ratio of GDP on life expectancy, under-five mortality and infant mortality is positive and significant in Sub Saharan Africa, Middle East and North Africa. More recently, using fixed effect and random effect estimators on 40 Sub Saharan Africa over 1995-2010, Novignon et al (2012) find that health care expenditure was associated with increase in life expectancy at birth and reduction in death and infant mortality rates. The results also show that while both private and public sources of health care expenditure were significantly associated with improved health outcomes, public health care expenditure had relatively larger impact. Ricci and Zachariad (2006), use data from 72 countries covering the time period from 1961 to 1995, in order to investigate the determinants of public health outcomes in a macroeconomic perspective. They also take into cognizance households' choices concerning education, health related expenditure and savings. The results are that there is an evidence for a dual role of education as a determinant of health outcomes. Sparrow *et al* (2009) on the other hand, using panel data set of 207 Indonesian districts over a 4-year period from 2001 to 2004, concluded that district-level public health spending is largely driven by central government transfers.

Therefore, increase in public expenditure is likely to increase health outcome only if institutions in place ensure efficient use of resources. In this hypothesis, differences in governments' records in terms of poverty reduction, performance of public service delivering including health care service, can be attributed to differences in the incentives for politicians to allocate public resources. These misallocations depend on the extent to which poor people can hold government accountable for lack of information about service quality, lack of credibility of political promises, and polarization of voters on social and ideological grounds.

The fact that increasing resources devoted to health services delivery does not necessarily produce more result can be explained by inefficiency in resources utilization and other forms of misallocation. For example, poor targeting and/or institutional inefficiencies such as leakage in public spending and weak institutional capacity is on raison. In developing countries in general and Africa in particular, a poor budget management has frequently been cited as main reason of why Governments in developing countries find it difficult to translating public spending into effective services (World Bank, 2003). In this perspective, managing public resources to promote development (i.e health status) required well-trained, skillful personnel, working in an institutional setting with an incentive system that reduces frauds, imposes constraints on decision makers and promotes cost efficacy. The efficiency of service delivery is greatly influenced by the allocation of resources within different type of expenditure such as wages, construction, and so on. The allocation of funds depends in turn on the quality of governance. The weak relationship between expenditure and health outcomes can also be explained by the fact that the cost effectiveness of different measures varies widely. For example, the provision of health services, an expansion of hospitals does have less impact on child mortality rates than spending on immunization programs and malaria control (Wolf, 2007). In addition, according to the World Bank and IMF, (2005) the number of people involved in decision making and service delivery, and the dependency on the discretionary behavior of the individuals provide opportunities for the leakage of funds. Furthermore, the difficult working conditions and uncompetitive salaries can reduce the accountability of service provision, fostering absenteeism and low quality.

Many empirical studies suggest that improved governance leads to better development outcomes including health. For example, Kaufmann et al.(1999) and Kaufmann et al.(2004) show that governance indicators including voice and accountability, political stability and violence, government effectiveness regulatory burden, rule of law and graft have a strong direct impact on infant mortality. De La Croix and Delavallade (2006) find that countries with high corruption invest more in housing and physical capital in comparison with health and education. Using 91 developing countries for 1990, 1997 and 2003, Rajkumar and Swaroop (2008) show that public health spending lowers the child mortality rates more in countries with good governance (as measured by a corruption index and bureaucratic index). More exactly, a 1% increase in the share of public health spending in GDP lowers the under-5 mortality rate by 0.32% in countries with good governance, 0.2% in countries with average governance, and has no impact in countries with weak governance. Their findings are supported by the latest World Health Report stating that “effective governance isthe key to improving efficiency and equity” (World Health Organization, 2011). In the same vein, Wolf (2007) uses simultaneous equations for year 2002, finds that control over corruption index has a negative coefficient and significant meaning that more control over corruption could reduce infant mortality. Using cancer mortality rate as measure of health outcome. Radin (2008) use data on 26 countries of Central and Easten Europe over the period 1980 to 2003 and finds that in both the short and long run, World Bank funding has no independently significant effect on cancer mortality and the only significant effect is when it is in interaction with corruption or institutional effectiveness. This finding underlines the need for the consideration of domestic factors (corruption and institutional effectiveness) when analyzing the impact of international funding on health care sector performance because of their ability to affect the goals of international lending agencies such as the World Bank. Using cross sectional analysis for 37 African countries, Olafsdottir et al. (2011) show that governance, in particular sustainable economic opportunities,” is significantly associated with health outcome measured by under five mortality rate and remains so even after controlling for the other healthcare and non-healthcare factors.

3- Empirical methodology

3.1- Specification and estimation strategy

Estimation using panel data has several advantages over purely cross-sectional estimation. First, working with a panel allows taking into account how public spending on health and governance over time within a country may have effect on the country’s health care system performance. Panel dada yields more degrees of freedom by adding the variability of time-series dimension. Second, in a panel context, we are able to control for unobserved country-specific effects and thereby reduce bias in the estimated coefficients. Indeed, ignoring the time-specific or country-specific unobserved effects that exist among countries in the conventional time series and cross-sectional studies on health care performance leads to bias results. Finally, our panel estimator also controls for the potential endogeneity of all explanatory variables.

Based on economic and econometric reasoning, data availability and previous studies on health outcome, the specification we adopt here is a dynamic two-way error components fixed effects model. This allows to control for both country specific effects and time specific effects for each year time period. The following general specification is used for the study:

$$\ln(HS)_{it} = \gamma_0 + \gamma_1 \ln(HS)_{i\,t-1} + \gamma_2 \ln(pubh\exp)_{it} + \gamma_3 gov_{it} + \gamma_4 gov_{it} \ln(puh\exp)_{it} + \beta X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

With HS_{it} being health outcome measured by using national-level probabilistic measures of health status that are widely used: infant mortality rate, child mortality rates, life expectancy at birth and crude death rate for a country i at time t. These health status indicators are thought to capture the overall performance of the health system and are selected to facilitate comparison of results with previous studies; $HS_{i\,t-1}$ is previous health outcome to account for robustness the dynamics of adjustment for health outcome; $pubh\exp$ is the share of public health expenditure to gdp which helps measure public investment in health human capital. We assume that health care expenditures do not automatically translate into stocks of health human capital. However, we believe that, in general, the more resources a society devotes to health care, the larger will its stock of health human capital be over time, all things being equal. gov is measured of governance indicators that are related to public finance. $gov_{it} * \ln(pubh\exp)_{it}$ is an interactive term between governance and public health spending which account for the indirect impact of governance on health outcome. The interaction terms between public health expenditure ratio and the level of governance enable us to determine whether beyond the direct effect, governance increases efficacy of public expenditure. As discussed above, health expenditure might only have a positive effect on outcome, if there is a good institution in place, especially the institutions through which those expenditures were channeled. Therefore, public spending variables are interacted with governance to understand how public funding is affected by quality of governance in a country in any given year. Two measures of governance indicators were used to capture different dimensions of governance and see whether our results are robust to alternate measures of governance quality: the index of government effectiveness $(goeff)$ that measures the perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation and the credibility of the government's commitment to such policies. The values range from -2.5 to 2.5, with higher scores corresponding to better outcomes; the corruption perception index (cpi) measuring corruption within the political system, which among other things reduces the effectiveness of government**.** The score a country receives for each year ranges from 1 (worst) to 10 (best).

X_{it} is a vector of control variables made up of socio-economic characteristics. Control variables (X_{it}) are driven by literature, intuition and pragmatics including the availability of the data and are the following: Per capita real income ($gdppc$) is used to measure economic performance assuming that country with good economic performance is more likely to spend more in public service delivery such as health care. It can acts as a control variable for the demand for health services. We expect that the higher a country's per capita income the better the health care sector performance; health expenditure per capita $h\exp pc$ can affect the quality of health care. It has also been found that increase in medical care spending has direct positive effects on health outcome (Phelps, 2002), Fertility rate ($frate$) high fertility implies high share of children. Thus high health costs for pregnant women and children and negative effect on health outcome is expected. As far as it concerns education, we use primary enrolment rate (*prienrate*) of children education indicator. Education allows more access to health-related knowledge which is important in health production function. We also used physical infrastructure (*sanf*) measured by the percentage of the population with sustainable access to safe drinking water sources, population density (*denpop*) is expected to reduce the cost of service provision on a per capita basis. Also the costs to the health facilities in term of transport costs and opportunity costs such as travelling time are lower. Therefore population density should have a positive association with health outcome indicators, urbanization rate (*urate*). μ_i is an unobserved country-specific effect (countries heterogeneity term), which may include all unobserved factors constant in time which has impact on health care performance. The term λ_t is the time specific effect and ε_{it} .is the error term.

3.2- Estimation procedure

From equation (1) three kinds of estimators are used: OLS estimator for cross-sectional analysis in order to assess the long-run effects of institution quality on health outcomes which are long-run phenomena, fixed effect estimator to account for unobservable heterogeneity effect that may bias our estimates and Generalized Method of Moment (GMM) estimator to better understand the dynamics of adjustment for a given health outcome and endogeneity. This can allow us to overcome both inadequate specification and inappropriate estimation techniques which could lead to biased results since each of the techniques has its strength and weakness (with a view to ascertaining the robustness of our study findings).

The cross-sectional analysis uses data averaged over 1996-2012, such that there is one observation per country. This regression is performed using a simple OLS estimator, corrected for heteroscedasticity.

A number of standard diagnostics test were performed in order to choose appropriate estimation technique. We test the hypothesis that the constant terms are all equal for all countries with an *F* test. Under the null hypothesis of equality, the efficient estimator is pooled least squares (POLS). If the null hypothesis was rejected, we have made the distinction between fixed end random effects models. The specification test devised by Hausman (1978) is used to test for orthogonality of the random effects and the regressors. The test is based on the idea that under the hypothesis of no correlation, both OLS in the *LSDV* model and *GLS* are consistent, but *OLS* is inefficient, whereas under the alternative, *OLS* is consistent, but *GLS* is not. Breusch Pagan Langrage multiplier test was also used to test Random Effects against POLS. The null hypothesis is that the variance of heterogeneity variable is null**.**
As previous performance tends to influence current economic outcome, we account for robustness the dynamics of adjustment for health outcome. Therefore, we estimated a dynamic panel model with lagged dependent variable using Generalized Method of Moments (GMM) albeit keeping in mind the limited size of the sample. GMM is best suited in dealing with the endogeneity issues and is convenient for estimating extensions of the basic unobserved effects model (Wooldridge 2001). We use here the Arellano and Bond’s two-step estimator to estimate the model, because it is the most optimal. Following Arellano and Bover (1995) and Blundell and Bond (1998), the dynamic panel estimator uses instrumental variables based on previous realizations of the explanatory variables, to consider the potential joint endogeneity of other regressors as well.

As consistency of the GMM estimator depends on the validity of the instruments, we consider two specification tests suggested by Arellano and Bond (1991), Arellano and Bover

(1995), and Blundell and Bond (1998). The first is a Sargan/Hansen tests of over-identifying restrictions, which tests the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process. The second test examines the hypothesis that the error term ε_{it} is not serially correlated. In the system difference-level regression, we test whether the differenced error term is second-order serially correlated (by construction, the differenced error term is probably first-order serially correlated even if the original error term is not).

4- Data and descriptive statistics

We used data from a sample of 43 African countries[1]. Annual data on each country was collected for the time period covering 1996 and 2012. The criterion for selecting the countries is based on the availability of data. Except the government effectiveness index and corruption perception index which are respectively taken from Worldwide Governance Indicator (2014) and the University of Gothenburg's Quality of Government Institute (2014), other data are obtained from World Development Indicator (2014). Table 3 shows descriptive statistics. As it can be seen from table 3, over the period 1996-2012, the mean of life expectancy at birth is 55.03204 years, which is lower compared to the level of developed countries (how much in dc). The others health indicators (i.e infant mortality rates, under five mortality rates, death rates) are, on average, higher in Africa than developed world. For example, the mean of infant mortality rate and under five mortality rates are respectively 70.83755 per 1,000 births and 111.9836 per 1,000 births in Africa against xx and xx for developed countries. We noticed a large variation in health indicator between countries. Regarding government spending, their mean is very low (15.19%) compared to the average for the European Union that is more than 40%. The low proportion of the overall expenditure in GDP affects spending on education and health. Thus, although the shares of public expenditure in education and health sectors are relatively low in African countries (respectively 2.478905 % and 4.371437%), notice that these sectors alone receive over 60% of public expenditure; this reflects the importance of these sectors in the different development strategies of these countries. It is worth noting that the average share of public health spending in GDP ranges from less than 0.09% to 9.45%. Despite GDP growth is higher in African countries with regard to the world average (nearly 2%) on our period, the gross domestic product per capita is, on average, $1771.116 for which is lower than the world average. The fertility rate remains high in Africa (5.030327 children per woman). The population density is 78.91566 squares Kilometer and the urbanization rate has been on average 38.5808% whereas the access to sanitation facilities per population has been 38.97636%. With respect to governance indicators, the mean of the governance effectiveness index is -0.6828835 -closer to the minimum value-, indicating that the majority of the countries during this period have ineffective institutions. Again, the average value of the perception of corruption index is of 2.893268 which rang African countries among countries perceived high levels of corruption (Szeftel, 2000, P 292)

[1] Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo Dem. Rep., Congo Rep., Cote d'Ivoire, Djibouti, Egypt Arab Rep., Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia The, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Seychelles, South Africa, Sudan, Swaziland, Togo, Tunisia, Uganda, Zambia and Zimbabwe.

Table 3: **Descriptive statistics, cross-section; 1996 - 2012**

Variables	Obs.	Mean	Std. Dev.	Minimum	Maximum
Leb	43	55.03204	8.135575	35.13907	74.98746
U1mr	43	70.83755	29.31037	11.2	148
U5mr	43	111.9836	52.80177	13.1	266.4
Cdrate	43	12.69833	4.040358	4.173	27.619
Hexppc	43	172.6761	218.4581	10.20439	1652.979
Pubhexp	43	2.478905	1.242884	.0990414	9.45112
Goeff	43	-0.6828835	0.612722	-1.982005	1.20205
Cpi	43	2.893268	1.012848	0.08667	6.5
Gdppc	43	1771.116	2702.018	53.09856	14901.35
Denpop	43	78.91566	111.5307	2.071335	633.5226
Prienrate	43	73.24818	18.24218	25.20005	99.94653
Frate	43	5.030327	1.429599	1.45	7.772
Sanf	43	38.97636	27.3904	3.5	97.1
Urate	43	38.5808	17.82788	7.42	88.1

Source: Own's calculation

A visual analysis of scatter plots of dependent variables versus each predictor variable is presented at Graph below (Graph Scatter-Plot Matrix of Variables).

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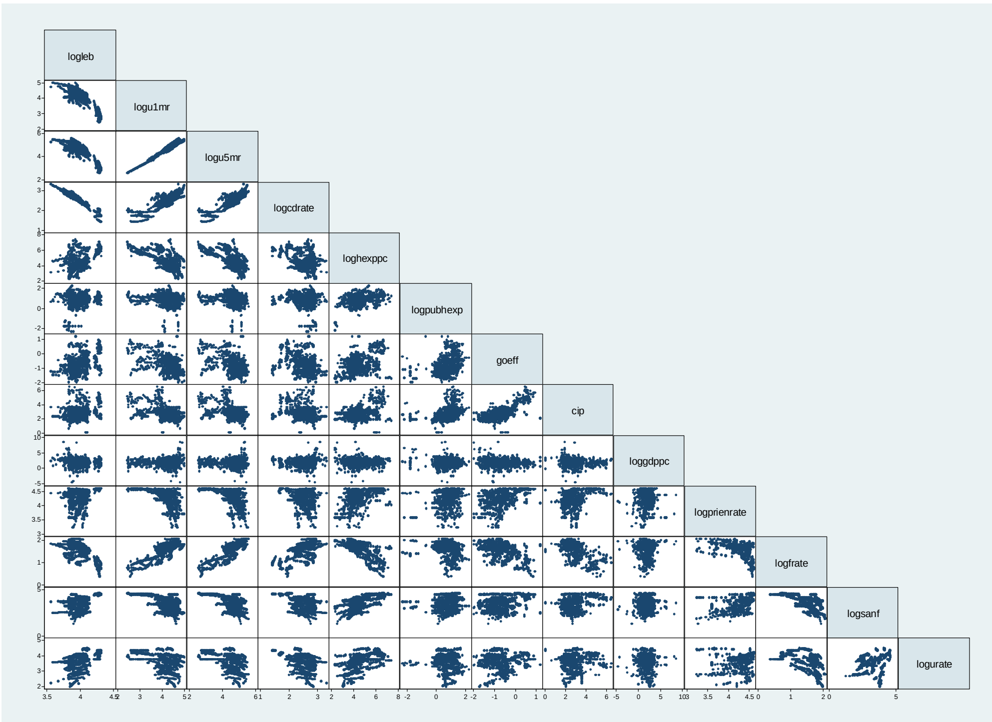

5- Empirical results

In this section, we first discuss specification tests issue. Second, we analyze public health expenditure and health outcome nexus, using cross-sectional, least square dummy variables and dynamic panel methodologies results.

5.1- Specification tests

In all cases, the results of diagnostic tests reveal that the null hypothesis of F test is rejected for regressions indicating that individual effect need to be considered (LSDV). As previously highlighted, if the null hypothesis in F test was rejected, we have made the distinction between fixed end random effects models by Hausman test. Hausman tests indicate fixed effects are the appropriate specification. The statistics tests confirm the intuitive expectation that health outcome in African countries are country specific, and that the health outcome has varied over time. Also, Breusch Pagan Langrage multiplier test confirm the presence of country specific effects. Again, diagnostic tests show that the GMM system estimator results satisfy the specification tests. There is no evidence of second serial correlation, but evidence of first serial correlation. Moreover, the regressions pass the Hansen tests and confirm the validity of the instruments. All these tests are performed at significant level of 1%.

Note in passing that, in all cases and for all estimators regressions reported in (1) and (2) present the results from estimating a simple version of equation (1) that does not include the governance variable. To capture the direct effect of governance quality on health status, we then include the governance indicators independently ((3) and (5)). Finally, we now interact public health spending with the governance variables and include this as an additional regressor ((4) and (6)). Interpreting our results, we explore two causal mechanisms by which governance can affect health outcome, and conduct a range of robustness tests to assess whether governance is causally related to better health outcome. First, by increasing the level of income, and allowing households to spend more on health, better governance could have an ‘’income effect’’ on health status. Second, better governance may allow for greater effectiveness of health spending and will therefore allow for greater effectiveness of service delivery for the poor. In line with this thinking, if the ‘’income effect’’ is valid, we would expect the coefficient on per capita to be of right sign and significant, and the coefficient on governance indicators to be insignificant. Also, better governance quality lead to improvements in the health indicators when the coefficient on the governance is of the right sign and statistically significant at 10% or less. In addition, the relationship between governance quality and public health expenditure is stronger when the coefficient of the interaction term of the governance measure with public health expenditure is statistically significant at 10% or less. Health spending has a stronger (positive impact on life expectancy at birth or negative impact on infant mortality, death rate) in countries with good policies.

5.2- Cross section estimations

Tables A1, A2, A3 and A4 present respectively cross-section results for live expectancy at birth, infant mortality rate, under five mortality rate and crude death rate. Health expenditure per capita is significantly associated live expectancy at birth and crude death rate with expected sign. But health expenditure per capita has no significant effect on the other health outcomes. Similar results are found with public health expenditure when direct effect of governance quality is not controlled for. This finding is in line with the viewpoint of Filmar and Pritchett (1996) that public health expenditure does not any significant impact on health sector performance –child and infant mortality rate. However, our result contradicts with Gupta et al. (2001) who conclude to a significant relationship between public spending on health and health status and argued that public health policy matters more to the poor. Model specification using government effectiveness index and corruption perception index show no significant direct effect of governance on health status-live expectancy at birth, infant mortality rate and child mortality rate (see colons 3 and 5; appendix A). In these colons, as governance indicators have no significant direct effect on any health outcomes and the coefficients associated to income per capita are statistically significant for live expenditure and crude death regressions, one may conclude governance has ‘’income effect’’ on these health variables. When we introduce the interaction variables –governance measures with public health spending-, we notice that for life expenditure at birth and crude death rate regressions, governance quality leads to improvements in life expectancy at birth and reduction in crude death rate because the coefficients on the governance indicators are of the right sign and statistically significant at 10% or less (direct effect). The coefficients of the interaction term of the governance measure with public health expenditure - government effectiveness index with public health expenditure and corruption perception index with public health expenditure- are significant at 10% or less. In other words, health spending has a stronger (positive impact on life expectancy at birth and stronger negative impact on death rate) in countries with good policies. In addition, in these regressions, public health expenditure affect significantly health outcome. As consequence, governance indicators measured by government effectiveness index and corruption perception index have indirect effect on crude death rate and life expectancy at birth. Thus, public health spending is more effective in improving life expectancy at birth and decreasing crude death rate in countries with good governance quality. These regressions show that apart from the fact that governance namely government effectiveness improves the efficacy of public health spending governance do have another channel by which it improves life expectancy at birth and crude death rate. Overall, the share of public health spending to GDP does not significantly affect health status when governance is accounted for. Governance has a positive ‘’income effect’’ on life expectancy at birth and on crude death rate.

Some controls variables have significant effect on health outcomes. For example, in all cases fertility rate increases significantly infant mortality rate and child mortality rate. Countries with higher fertility rate have higher infant mortality and under five mortality rate.

5.3- Fixed effect estimations

The same regressions are implemented using fixed effect estimator in order to check the robustness of the cross sectional findings. Tables B1, B2, B3 and B4 summarize respectively fixed effect estimations results for life expectancy at birth, infant mortality rate, child mortality rate and crude death rate. Here, the number of variables that have significant effect on health outcome has increased. In all cases, health expenditure per capita has a significant impact on health status with the right sign (P=0.000). Similar results are found by Anyawu et al (2009) who argue that Health expenditures have a statistically significant effect on infant mortality and under-five mortality. Health expenditure per capita affects positively life expectancy at birth and negatively infant mortality rate, under five mortality rate and crude death rate. These results reveal that countries with higher health expenditure per capita have better health outcome. With exception for crude death regression where the coefficient on public health expenditure is significant at 5%, public health expenditure fails to yield significant effect on health outcome when governance quality is not controlled for. With few exceptions, we figured out that governance indicators have significant direct impact on health outcome showing that good governance quality improves directly health status. This suggests the existence of another channel aside public health spending channel. As we do not observed any income effect of governance on health status, one may argue that by increasing tax revenue a ratio of GDP, better governance may for example allow for greater resources to be mobilized for social sector spending. Moreover, when we add the interaction term of governance measure with public health expenditure we noticed that the coefficient on public health expenditure has changed and become statistically significant. This change holds more often for when we interact government effectiveness with public health expenditure. For instance, regression reported in colon 4 reveal that increase in public health spending is associated with significant increase in life expectancy at birth, decrease in infant mortality rate, decrease in under five mortality rate and decrease in death rate. It is worth noting that the coefficient on the interaction term and those of governance indicators are in most care cases significant. Therefore, governance improves indirectly life expectancy at birth, infant mortality rate, under five mortality rate and crude death rate through public health expenditure. This corroborates Rajkumar and Swaroop (2008) and Bingjie Hu (2010) findings. The index of governance effectiveness has positive efficacy effect on life expectancy at birth. The governance effectiveness has negative efficacy effect on child mortality rate less than one year. The Index of corruption perception has negative efficacy effect on child mortality rate less than one year. Governance effectiveness has negative income effect on child mortality rate under five years. The Index of corruption perception has negative efficacy effect on child mortality rate less than five years. The index of governance effectiveness has negative efficacy effect on crude death rate.

The coefficients associated with control variables are often significant and have expected sign. For example, increase in access to good sanitation increases life expectancy at birth and reduces infant mortality, child mortality and crude death rate.

5.4- Dynamic panel results

Again, we performed the same regressions using GMM system estimator on dynamic panel for robustness check. Tables C1, C2, C3 and C4 report respectively GMM system estimations results for life expectancy at birth, infant mortality rate, child mortality rate and crude death rate. The results obtained from this estimator show that in all health outcomes regressions previous values of health affect significantly current values of health as we expected. This means that we really need to account for this adjustment process in health dynamic. GMM estimator has improved the importance of health expenditure per capita and public health spending in explaining health outcome compared to fixed effect estimators. In all cases, health expenditure per capita affects significantly all health outcomes with expected sign. Also, public health expenditure when governance is not accounted for. After including governance indicators –government effectiveness index and corruption perception index- the coefficients on public health expenditure are still significant with smaller standard error and higher size. This result holds for all health outcome variables. In addition, the corruption perception index has significant direct effect on all health outcomes while government effectiveness index has a direct significant effect only on life expectancy at birth. The direct effect of corruption perception index on health outcome combine with the significant effect of public health spending on health outcome means that government improves the effectiveness of health spending –provision of health services-. But as income effect of governance is insignificant, we conclude that governance improves health outcome through increase in taxes revenue. When we add interaction term as additional variable to governance, we observed that, in most cases, the interaction terms are not statistically significantly showing that governance does not improve efficacy of public health spending.

Concluding remarks

This paper examines some determinants of various health outcomes in Africa, with particular focus on governance using panel data techniques. We find that health expenditure per capita and public health spending influence significantly health outcomes. We also figure out that the role of governance in improving health expenditure efficacy is mixed. This cannot be interpreted as governance has no impact on the efficacy of public health spending for two main reasons. First, health expenditure and governance may only imperfectly and partially measure the true amount of resources and quality of institution, respectively these two variables are supposed to reflect. Secondly, we recognize the limits of these broader governance indicators, notably when it is possible to conceive of thresholds and non-linearities in the relationships involving governance.

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Appendices

CODE	VARIABLES DEFINITION	SOURCE	PERIOD COVERED
GDPPC	gross domestic product per capita (constant 2005 us dollar)	WDI(world development indicators)	1996 to 2012
PRIENRATE	children enrollment(% gross)	WDI(world development indicators)	1996 to 2012
DENPOP	population density(people per sq.km of land area)	WDI(world development indicators)	1996 to 2012
SANF	improved sanitation facilities (% of population with access)	WDI (world development indicators) 2013	1996 to 2012
PHEXP_GDP	Health expenditure, public (% of GDP)	WDI (world development indicators) 2013	1996 to 2012
HEXPPC	Health expenditure per capita ,ppp (constant 2005 international $	WDI (world development indicators) 2013	1996 to 2012
LEB	Life expectancy at birth, total (years)	WDI (world development indicators) 2013	1996 to 2012
U1MR	Mortality rate, infant (per 1,000 live births)	WDI (world development indicators) 2013	1996 to 2012
U5MR	Mortality rate ,under -5 (per 1,000 live births)	WDI (world development indicators) 2013	1996 to 2012
CDRATE	Death rate, crude (per 1,000 people)	WDI (world development indicators) 2013	1996 to 2012
FRATE	Fertility rate, total (births per woman)	WDI (world development indicators) 2013	1996 to 2012
ITUB	Incidence of tuberculosis (per	WDI (world development	1996 to 2012

	woman	indicators) 2013	
GOEFF	Government effectiveness: estimate	WDI (world development indicators) 2013	1996 to 2012
CPI	Corruption perceptions index	The international transparency	1996 to 2012
URATE	Urbanization rate	WDI (worldwide development indicator) 2013	1996 to 2012

Appendice A: Cross sectional regressions: OLS estimators

Table A1 Regression for life expectancy at birth

	(1)	(2)	(3)	(4)	(5)	(6)
loghexppc	-.056687* (0.072)					
logpubhexp		.0298882 (0.352)	.0295891 (0.406)	-.1459205* (0.078)	.0523479 (0.149)	.2787285** (0.037)
Goeff			.0010335 (0.981)	.1595402** (0.046)		
Cpi					-.042736 (0.133)	.0438163 (0.485)
Goeff* logpubhexp				-.1794482** (0.032)		
Cpi*logpubhexp						-.0872816 (0.100)
loggdppc	-.0324579** (0.023)	-.0235187* (0.084)	-.0234004* (0.090)	-.0040487 (0.818)	-.029496* (0.058)	-.0251502 (0.123)
logdenpop	.0000953 (0.995)	.0167831 (0.189)	.0168505 (0.186)	.0061318 (0.636)	.0119015 (0.263)	.0043318 (0.700)
logprienrate	.0475292 (0.36)	.004677 (0.907)	.0040778 (0.931)	-.0517386 (0.368)	.0005493 (0.990)	-.0065305 (0.899)
logfrate	-.311098*** (0.000)	-.2158913*** (0.001)	-.2147357*** (0.013)	-.2854177*** (0.001)	.3138439*** (0.003)	-.3181862*** (0.001)
logsanf	.002742 (0.900)	-.0267918 (0.155)	-.026656 (0.192)	-.0204631 (0.268)	-.0292474 (0.161)	-.0235026 (0.246)
logurate	.0584157* (0.090)	.064449* (0.061)	.0646731* (0.081)	.0385646 (0.24)	.0429505 (0.250)	.0412902 (0.222)
Cons	4.392203*** (0.000)	4.139599*** (0.000)	4.139508*** (0.000)	4.735539*** (0.000)	4.532679*** (0.000)	4.368189*** (0.000)
Observations	43	44	44	44	44	44
R-squared	0.6239	0.5581	0.5581	0.6308	0.5884	0.6239
F test	13.31*** (0.0000)	10.01*** (0.0000)	8.63*** (0.0000)	8.07*** (0.0000)	9.42*** (0.0000)	11.17*** (0.0000)

Table A2 Regression for infant mortality rate under one-year

	(1)	(2)	(3)	(4)	(5)	(6)
loghexppc	.0785846 (0.340)					
logpubhexp		.005285 (0.938)	.0273535 (0.733)	.2992165 (0.279)	-.0053835 (0.951)	-.4411261 (0.286)
Goeff			-.0762683 (0.501)	-.3217938 (0.195)		
Cpi					.0202999 (0.785)	-.146298 (0.460)
Goeff*				.2779638		

logpubhexp				(0.275)		
Cpi*logpubhexp						.1680017 (0.327)
loggdppc	.0391743 (0.235)	.0270725 (0.422)	.0183407 (0.561)	-.0116349 (0.777)	.0299117 (0.374)	-.4411261 (0.286)
logdenpop	.0003174 (0.992)	-.0202546 (0.457)	-.0252293 (0.384)	-.0086262 (0.809)	-.0179358 (0.509)	-.0033656 (0.921)
logprienrate	-.2738728* (0.081)	-.2162089* (0.095)	-.1719887 (0.189)	-.0855296 (0.586)	-.2142481 (0.110)	-.2006208 (0.167)
logfrate	1.362269*** (0.000)	1.256065*** (0.000)	1.170791*** (0.000)	1.280277*** (0.000)	1.302593*** (0.000)	1.310951*** (0.000)
logsanf	-.0339791 (0.589)	.0046618 (0.930)	-.0053615 (0.922)	-.0149542 (0.778)	.0058283 (0.917)	-.0052295 (0.926)
logurate	.0603622 (0.504)	.0669882 (0.432)	.0504548 (0.594)	.0908967 (0.343)	.0772001 (0.452)	.080396 (0.407)
Cons	2.639781*** (0.008)	2.865001*** (0.003)	2.871745*** (0.003)	1.948498* (0.069)	2.678286** (0.049)	2.994899** (0.037)
Observations	43	44	44	44	44	44
R-squared	0.825	0.8174	0.8198	0.8306	0.8178	0.8260
F test	25.4*** (0.000)	17.10*** (0.000)	14.50*** (0.000)	32.17*** (0.000)	15.02*** (0.000)	35.18*** (0.000)

Table A3 Regression for infant mortality rate under five-year

	(1)	(2)	(3)	(4)	(5)	(6)
loghexppc	.1329142 (0.143)					
logpubhexp		-.0198652 (0.801)	-.0247879 (0.788)	.2796092 (0.339)	-.0611104 (0.517)	-.501716 (0.244)
Goeff			.0170126 (0.893)	-.257895 (0.318)		
Cpi					.0784807 (0.308)	-.0899765 (0.650)
Goeff* logpubhexp				.3112279 (0.263)		
Cpi*logpubhexp						.1698767 (0.337)
loggdppc	.0201087 (0.481)	.0005545 (0.986)	-.0355894 (0.224)	-.0310606 (0.484)	.0115314 (0.723)	.0030731 (0.934)
logdenpop	-.0008786 (0.980)	-.0366991 (0.194)	-.0355894 (0.224)	-.0169994 (0.640)	-.0277345 (0.279)	-.0130017 (0.697)
logprienrate	-.2258485 (0.103)	-.1306844 (0.253)	-.1405482 (0.258)	-.0437425 (0.765)	-.1231041 (0.325)	-.1093247 (0.431)
logfrate	1.730042*** (0.000)	1.53545*** (0.000)	1.554472*** (0.000)	1.67706*** (0.000)	1.715331*** (0.000)	1.723782*** (0.000)
logsanf	-.0748062 (0.218)	-.0084107 (0.872)	-.0061748 (0.913)	-.0169155 (0.746)	-.0039012 (0.943)	-.0150824 (0.783)
logurate	.0185797 (0.829)	.0214066 (0.799)	.0250945 (0.797)	.0703761 (0.485)	.0608865 (0.559)	.0641181 (0.515)
Cons	2.352993*** (0.011)	2.816825*** (0.001)	2.815321*** (0.002)	1.781588*** (0.082)	2.09497 (0.112)	2.41512* (0.088)
Observations	43	44	44	44	44	44
R-squared	0.8727	0.8570	0.8571	0.8667	0.8615	0.8674
F	29.32*** (0.000)	19.20*** (0.000)	16.53*** (0.000)	35.66*** (0.000)	18.66*** (0.000)	36.88*** (0.000)

Table A 4: Regression for crude death rate

	(1)	(2)	(3)	(4)	(5)	(6)
loghexppc	.2012992*** (0.011)					
logpubhexp		-.0634342 (0.230)	-.075495 (0.240)	.3506398* (0.076)	-.1183626* (0.077)	-.8001193** (0.015)
Goeff			.0416819 (0.725)	-.3431698* (0.066)		
Cpi					.1045169 (0.166)	-.1561398 (0.248)
Goeff* logpubhexp				.4356975** (0.031)		
Cpi*logpubhexp						.2628531** (0.038)
loggdppc	.0762423** (0.044)	.0502048 (0.135)	.0549768 (0.109)	.0079912 (0.860)	.0648232* (0.081)	.0517356 (0.205)
logdenpop	.022531 (0.509)	-.0316321 (0.294)	-.0289134 (0.350)	-.0028886 (0.929)	-.0196936 (0.473)	.0031028 (0.913)
logprienrate	-.1947448 (0.112)	-.0612818 (0.359)	-.0854488 (0.367)	.0500725 (0.681)	-.0511868 (0.487)	-.0298656 (0.763)
logfrate	.8352865*** (0.000)	.5254012*** (0.000)	.5720047*** (0.011)	.7436194*** (0.002)	.7649578*** (0.005)	.7780348*** (0.001)
logsanf	-.0545622 (0.352)	.0463254 (0.324)	.0518033 (0.320)	.036767 (0.435)	.0523309 (0.319)	.03503 (0.475)
logurate	-.1113761 (0.125)	-.1148108 (0.105)	-.1057751 (0.181)	-.042384 (0.564)	-.0622333 (0.459)	-.057233 (0.428)
Cons	1.437043* (0.080)	2.249011*** (0.001)	2.245325*** (0.001)	.7981701 (0.355)	1.287682 (0.232)	1.783051* (0.083)
Observations	43	44	44	44	44	44
R-squared	0.6563	0.5615	0.5636	0.6396	0.5936	0.6508
F	13.64*** (0.000)	9.41*** (0.000)	8.05*** (0.000)	5.58*** (0.000)	8.65*** (0.000)	6.87*** (0.000)

Appendice B: Fixed effect estimators

Table B1: Regression for life expectancy at birth

	(1)	(2)	(3)	(4)	(5)	(6)
loghexppc	.0401975*** (0.000)	-	-	-	-	-
logpubhexp	-	.0078839 (0.152)	.005297 (0.331)	.0254336*** (0.002)	.0075762 (0.176)	-.0034771 (0.765)
Goeff	-	-	.0275447*** (0.000)	.0191177*** (0.005)	-	
Cpi				-	.0027554 (0.523)	.0002091 (0.966)
Goeff* logpubhexp	-		-	.0186458*** (0.001)	-	-
Cpi*logpubhexp					-	.0043926 (0.278)
loggdppc	.0017502 (0.245)	.0017483 (0.276)	.0015113 (0.340)	.0008943 (0.572)	.0018239 (0.262)	.0017107 (0.293)
logdenpop	.1477939*** (0.000)	.1656519*** (0.000)	.1755769*** (0.000)	.1793794*** (0.000)	.1665271*** (0.000)	.1681204*** (0.000)
logprienrate	.0022222	.0100024	0062168	.0034051	.0079597	.007601

	(0.867)	(0.480)	(0.657)	(0.806)	(0.580)	(0.597)
logfrate	.2339039*** (0.000)	.1397098*** (0.000)	.1254589*** (0.000)	.1377805*** (0.000)	.1422025*** (0.000)	.1465186*** (0.000)
logsanf	.0921449*** (0.000)	.0856725*** (0.000)	.0839352*** (0.000)	.0883078*** (0.000)	.0908647*** (0.000)	.0907896*** (0.000)
logurate	.100493*** (0.001)	.1410946*** (0.000)	.1294361*** (0.000)	.1129794*** (0.001)	.1386948*** (0.000)	.136901*** (0.000)
Cons	2.225522*** (0.000)	2.327602*** (0.000)	2.395625*** (0.000)	2.403548*** (0.000)	2.315907*** (0.000)	2.316389*** (0.000)
Obs	667	680	680	680	669	669
R **ajusted**	0.4675	0.4086	0.4257	0.3958	0.4087	0.4098
F test, p-value	83.98*** (0.0000)	76.12*** 0.0000	78.33*** (0.0000)	77.16*** (0.0000)	73.09*** 0.0000	69.10*** (0.0000)
Hausman test, p-value	91.59*** (0.0000)	78.90*** (0.000)	80.17*** (0.000)	93.64*** (0.000)	81.09*** (0.000)	91.98*** (0.000)

Table B2: Regression for mortality rate under one-year

	(1)	(2)	(3)	(4)	(5)	(6)
loghexppc	-.284217*** (0.000)					
logpubhexp		-.0190932 (0.262)	-.0154996 (0.364)	-.0737073*** (0.003)	-.0139945 (0.411)	.044115 (0.212)
Goeff			-.0382638*** (0.056)	-.0139043 (0.514)	-	-
Cpi			-	-	-.0609531*** (0.000)	-0475667*** (0.001)
Goeff* logpubhexp			-	-.0538984*** (0.002)	-	-
Cpi*logpubhexp			-	-	-	-.0230928*** (0.061)
loggdppc	-.0134563*** (0.001)	-.0067624 (0.174)	-.0064331 (0.195)	-.0046496 (0.348)	-.0075228 (0.128)	-.0069277 (0.161)
logdenpop	-.3632799*** (0.000)	-.5140134*** (0.000)	-.5278007*** (0.000)	-.5387923*** (0.000)	-.4924715*** (0.000)	-.5008478*** (0.000)
logprienrate	-.0861152** (0.019)	-.1499181*** (0.001)	-.1446592*** (0.001)	-.1365317*** (0.002)	-.1296383*** (0.003)	-.1277523*** (0.004)
logfrate	-.0348494 (0.724)	.5075666*** (0.000)	.5273632*** 0.000	.491746*** (0.000)	.5010323*** (0.000)	.4783418*** (0.000)
logsanf	-.1689777*** (0.000)	-.176363*** (0.002)	-.1739497*** 0.002	-.1865894*** (0.001)	-.2226981*** (0.000)	-.2223029*** (0.000)
logurate	.0029107 (0.973)	-.3047478*** (0.003)	-.2885522*** (0.005)	-.240982** (0.020)	-.321972*** (0.002)	-.312542*** (0.002)
Cons	7.787946*** (0.000)	7.583207*** (0.000)	7.488712*** (0.000)	7.465809*** (0.000)	7.808334*** (0.000)	7.805797*** (0.000)
Obs	667	680	680	680	669	669
R **ajusted**	0.6985	0.5578	0.5604	0.5672	0.5729	0.5753
F test, p-value	85.14*** (0.0000)	54.38*** (0.0000)	54.48*** (0.0000)	55.22*** (0.0000)	55.72*** (0.0000)	54.91*** (0.0000)
Hausman test, p-value	68.61*** (0.0000)	81.73*** (0.0000)	83.05*** (0.0000)	86.83*** (0.0000)	80.86*** (0.0000)	86.15*** (0.0000)

Table B3 Regression for mortality rate under five-year

	(1)	(2)	(3)	(4)	(5)	(6)
loghexppc	-.323074***					

	(0.000)					
logpubhexp		-.0306395 (0.124)	-.0272567 (0.173)	-.0996396*** (0.001)	-.0243662 (0.220)	.0615392 (0.135)
Goeff			-.0360201 (0.124)	-.0057284 (0.818)		
Cpi					-.0747469*** (0.000)	-.0549574*** (0.002)
Goeff* logpubhexp				-.0670243*** (0.001)		
Cpi*logpubhexp						-.034139** (0.018)
loggdppc	-.0172219*** (0.001)	-.010079* (0.083)	-.009769* (0.093)	-.0075511 (0.193)	-.0110404* (0.056)	-.0101605* (0.078)
logdenpop	-.4766986*** (0.000)	-.6453222*** (0.000)	-.6583011*** (0.000)	-.6719696*** (0.000)	-.6199749*** (0.000)	-.632358*** (0.000)
logprienrate	-.1415245*** (0.001)	-.2132779*** (0.000)	-.2083274*** (0.000)	-.1982206*** (0.000)	-.1878102*** (0.000)	-.1850221*** (0.000)
logfrate	-.1653502 (0.159)	.4502403*** (0.001)	.4688761*** (0.000)	.424585*** (0.001)	.4411463*** (0.001)	.407602*** (0.002)
logsanf	-.217368*** (0.000)	-.2220951*** (0.001)	-.2198232*** (0.001)	-.2355411*** (0.000)	-.2805478*** (0.000)	-.2799636*** (0.000)
logurate	.012418 (0.903)	-.326103*** (0.007)	-.3108571*** (0.010)	-.2517021** (0.037)	-.3453608*** (0.004)	-.33142*** (0.006)
Cons	9.378913*** (0.000)	9.091955*** (0.000)	9.003*** (0.000)	8.97452*** (0.000)	9.371192*** (0.000)	9.367442*** (0.000)
Observations	667	680	680	680	669	669
R **ajusted**	0.6942	0.5644	0.5660	0.5736	0.5811	0.5849
F test, p-value	68.92*** (0.0000)	45.09*** (0.0000)	45.16*** (0.0000)	45.88*** (0.0000)	46.54*** (0.0000)	45.91*** (0.0000)
Hausman test, p-value	93.34*** (0.0000)	91.17*** (0.0000)	91.61*** (0.0000)	96.50*** (0.0000)	91.50*** (0.0000)	97.66*** (0.0000)

Table B4: Regression for crude death rate

	(1)	(2)	(3)	(4)	(5)	(6)
loghexppc	-.0711181*** (0.000)					
logpubhexp		-.0246854** (0.054)	-.0196872 (0.122)	-.060487*** (0.001)	-.0230337* (0.076)	-.0073302 (0.786)
Goeff			-.0532195*** (0.000)	-.0361451** (0.023)		
Cpi					-.0133413 (0.182)	-.0097237 (0.394)
Goeff* logpubhexp				-.0377793*** (0.003)		
Cpi*logpubhexp						-.0062406 (0.507)
loggdppc	-.0039434 (0.276)	-.0044529 (0.233)	-.003995 (0.280)	-.0027448 (0.458)	-.0047034 (0.212)	-.0045426 (0.230)
logdenpop	-.3833497 *** (0.000)	-.411712 *** (0.000)	-.4308882*** (0.000)	-.4385927*** (0.000)	-.4116293*** (0.000)	-.4138929*** (0.000)
logprienrate	-.0109152 (0.732)	-.0236671 (0.472)	-.0163528 (0.617)	-.0106559 (0.743)	-.0161849 (0.628)	-.0156752 (0.639)
logfrate	-.4874291***	-.3215786 ***	-.2940443***	-.3190097***	-.3298353***	-.3359672***

	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
logsanf	-.3111987*** (0.000)	-.2949656*** (0.000)	-.291609*** (0.000)	-.3004686*** (0.000)	-.3138883*** (0.000)	-.3137815*** (0.000)
logurate	.1631465** (0.030)	-.2224551*** (0.004)	-.1999294*** (0.009)	-.1665857** (0.031)	-.2188555*** (0.005)	-.2163071*** (0.006)
Cons	6.678555*** (0.000)	6.431107*** (0.000)	6.299678*** (0.000)	6.283624*** (0.000)	6.492032*** (0.000)	6.491346*** (0.000)
Observations	667	680	680	680	669	669
R **ajusted**	0.4934	0.4626	0.4733	0.4805	0.4639	0.4642
F test, p-value	81.75*** (0.000)	79.74*** (0.000)	81.52*** (0.000)	79.14*** (0.000)	76.35*** (0.000)	70.62*** (0.000)
Hausman test, p-value	114.67*** (0.000)	94.17*** (0.000)	96.07*** (0.000)	110.85*** (0.000)	97.50*** (0.000)	113.12*** (0.000)

Appendice C Dynamic panel-data estimation, two-step system GMM

Table C1: Regression for Life expectancy at birth

	(1)	(2)	(3)	(4)	(5)	(6)
loghexppc	- .0337918*** (0.002)	-	-	-	-	-
logpubhexp	-	.0408489** (0.018)	.0362119*** (0.005)	.0261081** (0.085)	.0454742*** (0.004)	.0454742*** (0.004)
Goeff	-	-	.016144** (0.066)	-.0119708 (0.227)		-
Cpi	-	-	-	-	-.0189566*** (0.000)	-.0189566*** (0.000)
Goeff* logpubhexp	-	-	-	.0135175 (0.235)	-	-
Cpi*logpubhexp	-	-	-		-	.0043926 (0.278)
loggdppc	-.0002204 (0.846)	.001647 (0.156)	.0013068 (0.273)	.000632 (0.273)	.0015581 (0.239)	.0015581 (0.239)
logdenpop	-.0051494** (0.079)	.0056104 (0.117)	.0052161 (0.153)	.0051089 0.115	.0037404 (0.141)	.0037404 (0.141)
logprienrate	.0139343 (0.284)	-.0042445 (0.744)	-.0015148 (0.908)	.0006728 (0.942)	-.0077831 (0.536)	-.0077831 (0.536)
logfrate	-.057949*** (0.009)	-.0125004 (0.700)	-.0312506 (0.391)	-.0175811 (0.565)	-.0685436 (0.226)	-.0685436 (0.226)
logsanf	.0134548*** (0.011)	-.0050978 (0.522)	-.0084323 (0.260)	-.0040828 (0.508)	-.0079343 (0.288)	-.0079343 (0.288)
logurate	.0071393 (0.237)	.0216871** (0.034)	.016144** (0.066)	.0141105* (0.048)	.009166 (0.427)	.009166 (0.427)
Hs(-1)	.9516331*** (0.000)	.8524788*** (0.000)	.8570683*** (0.000)	.8714065*** (0.000)	.841375*** (0.000)	.841375*** (0.000)
Cons	.3296356 (0.123)	.5145041 (0.228)	.5433049 (0.250)	.4611983 (0.252)	.775732 (0.230)	.775732 (0.230)
observations	625	637	637	637	627	627
AR(1) test, p-level	-0.50 (0.617)	-0.99 (0.322)	-1.17 (0.241)	-0.96 (0.335)	-2.20** (0.028)	-2.20** (0.028)
AR (2) test, p-level	0.98 (0.326)	-0.43 (0.665)	-0.11 (0.914)	0.50 (0.614)	-0.60 (0.552)	-0.60 (0.552)
Hansen test, p-level	42.18 (0.941)	40.58 (0.960)	41.15 (0.954)	40.00 (0.966)	39.79 (0.968)	39.79 (0.968)

Instruments	67	67	68	69	68	68

Table C2: Regression for infant mortality rate under one-year

	(1)	(2)	(3)	(4)	(5)	(6)
loghexppc	.0372456*** (0.003)					
logpubhexp	-	-0319295*** (0.011)	-.0255304*** (0.005)	.0004353 (0.969)	-035600*** (0.001)	-.0075455 (0.528)
Goeff	-	-	.0030912 (0.579)	-.0041921 (0.510)	-	-
Cpi	-	-	-		.0112819*** (0.005)	.007663** (0.031)
Goeff* logpubhexp	-	-	-	.0061694 (0.496)	-	-
Cpi*logpubhexp	-	-	-	-	-	-.0172153 (0.621)
loggdppc	.0009187 (0.593)	-.0010996 (0.302)	-.0007924 (0.244)	-.0008887 (0.282)	-.0006798 (0.410)	-.0003351 (0.706)
logdenpop	.0058922 (0.342)	-.0032725 (0.316)	-.0026084 (0.292)	-.0001777 (0.967)	-.0015504 (0.637)	-.0046071 (0.152)
logprienrate	.0015558 (0.928)	.0003051 (0.980)	-.0035318 (0.666)	.0068906 (0.540)	-.0027422 (0.741)	.003681 (0.776)
logfrate	-.0794045** (0.040)	-.07546*** (0.005)	-.07812*** (0.001)	-.1153145*** (0.002)	-.056088** (0.052)	-.0140294 (0.582)
logsanf	-.0124437 (0.235)	.0048655 (0.461)	.0056809 (0.184)	.0016592 (0.813)	.0085754 (0.126)	.0059454 (0.365)
logurate	-.0080444 (0.563)	-.0120776 (0.107)	-.0129454* (0.080)	-.0029488 (0.814)	-.0080728 (0.346)	.00646 (0.596)
Hs(-1)	1.110199*** (0.000)	1.04751*** (0.000)	1.051079*** (0.000)	1.088716*** (0.000)	1.051994*** (0.000)	1.0396*** (0.000)
Cons	-.49486*** (0.009)	-.045245 (0.656)	-.0443881 (0.612)	-.2413448*** (0.031)	-.1446196 (0.125)	-.22784*** (0.026)
observations	625	637	637	637	627	477
AR(1) test, p-level	0.36 (0.718)	-0.50 (0.616)	-0.29 (0.768)	0.67 (0.505)	-1.17 (0.241)	-0.74 (0.458)
AR (2) test, p-level	-0.20 (0.842)	-0.33 (0.744)	-0.35 (0.726)	0.04 (0.968)	-0.30 (0.767)	-0.94 (0.346)
Hansen test, p-level	35.44 (0.992)	39.02 (0.974)	35.21 (0.992)	39.53 (0.970)	37.14 (0.985)	27.13 (1.000)
Num.Instruments	67	67	68	69	68	69

Table C3 Regression infant mortality rate under five-year

	(1)	(2)	(3)	(4)	(5)	(6)
loghexppc	.049037*** (0.006)					
logpubhexp		-.0301498*** (0.004)	-.0236823*** (0.010)	-.0121711 (0.326)	-.033562*** (0.001)	-.101521** (0.039)
Goeff			-.0009055 (0.875)	-.0012939 (0.860)		
Cpi					.0099293** (0.024)	-.0237789 (0.199)
Goeff* logpubhexp				-.0059441 (0.519)		

Cpi*logpubhexp						.0319822* (0.046)
loggdppc	.0028464 (0.143)	.0002621 (0.729)	.0001611 (0.769)	.0009009 (0.239)	.0004407 (0.626)	.0003769 (0.743)
logdenpop	.0104137 (0.202)	-.0011284 (0.726)	-.00032 (0.923)	.0022785 (0.640)	.0008125 (0.783)	.0061331 (0.259)
logprienrate	-.0032563 (0.886)	-.0025282 (0.786)	-.0002973 (0.973)	.0043999 (0.676)	-.0036735 (0.705)	.0046142 (0.676)
logfrate	-.1808528*** (0.000)	-.1266978*** (0.000)	-.1379064*** (0.000)	-.1706426*** (0.001)	-.115287*** (0.000)	-.12647*** (0.005)
logsanf	-.0186141 (0.159)	.0082597 (0.118)	.0077565 (0.110)	.0069815 (0.137)	.0099782* (0.081)	.0060075 (0.330)
logurate	-.0037762 (0.801)	-.0107974 (0.169)	-.0101655 (0.273)	-.005646 (0.493)	-.0040744 (0.647)	-.0018718 (0.887)
Hs(-1)	1.156525*** (0.000)	1.068313*** (0.000)	1.077002*** (0.000)	1.100042*** (0.000)	1.074147*** (0.000)	1.0827*** (0.000)
Cons	-.6470534*** (0.010)	-.0988484 (0.220)	-.1385663 (0.154)	-.2496177*** (0.011)	-.2017746** (0.024)	-.2000143 (0.374)
observations	625	637	637	637	627	627
AR(1) test, p-level	2.49*** (0.013)	2.31** (0.021)	2.46*** (0.014)	2.71*** (0.007)	2.00** (0.046)	1.89* (0.059)
AR (2) test, p-level	1.14 (0.255)	0.10 (0.921)	0.24 (0.810)	0.64 (0.521)	0.01 (0.995)	0.24 (0.813)
Hansen test, p-level	37.28 (0.984)	31.33 (0.998)	30.25 (0.999)	32.85 (0.997)	32.84 (0.997)	33.34 (0.996)
Num.Instruments	67	67	68	69	68	69

Table C4: Regression for crude death rate

	(1)	(2)	(3)	(4)	(5)	(6)
loghexppc	.07704*** (0.005)					
logpubhexp		-.0972866*** (0.014)	-.0835042*** (0.007)	-.0491762 (0.235)	-.114288*** (0.012)	-.243909*** (0.016)
Goeff			.0286416 (0.206)	.0221767 (0.365)		
Cpi					.0543284*** (0.000)	-.0331111 (0.267)
Goeff* logpubhexp				-.0172035 (0.575)		
Cpi*logpubhexp						.0767959** (0.027)
loggdppc	.0011167 (0.642)	-.0038591 (0.174)	-.002622 (0.274)	-.0012295 (0.541)	-.0030753 (0.316)	-.0021675 (0.387)
logdenpop	.0107662 (0.133)	-.0140604 (0.126)	-.0121359 (0.138)	-.0143181 (0.129)	-.0069818 (0.368)	.001247 (0.859)
logprienrate	-.0345525 (0.280)	.0085352 (0.762)	-.0116043 (0.628)	-.0069945 (0.697)	.0109675 (0.701)	.0054458 (0.676)
logfrate	.1437246*** (0.009)	.0581896 (0.522)	.088467 (0.222)	.0807075 (0.301)	.1608742 (0.118)	.1967037*** (0.010)
logsanf	-.0291385** (0.035)	.0160003 (0.443)	.0146138 (0.497)	.0122682 (0.329)	.0136467 (0.455)	.0048966 (0.700)
logurate	-.0197109 (0.135)	-.0457644* (0.055)	-.0368075* (0.080)	-.0336642* (0.067)	-.0235205 (0.396)	-.0070878 (0.666)
Hs(-1)	.9190303***	.8055638***	.8022718***	.8061533***	.8305622***	.7828324***

	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cons	-.1074245 (0.624)	.5928205** (0.029)	.6116506*** (0.012)	.5614099** (0.013)	.1179254 (0.654)	.3025781 (0.159)
observations	625	637	637	637	627	627
AR(1) test, p-level	-1.25 (0.213)	-1.30 (0.193)	-1.51 (0.131)	-1.45 (0.147)	-2.32** (0.020)	-2.35** (0.019)
AR (2) test, p-level	-0.82 (0.415)	-1.83* (0.067)	-1.62 (0.104)	-1.59 (0.111)	-1.74* (0.082)	-1.55 (0.121)
Hansen test, p-level	38.24 (0.979)	42.27 (0.940)	41.18 (0.954)	41.22 (0.953)	41.07 (0.955)	37.95 (0.981)
Num.Instruments	67	67	68	69	68	69