J. Quant. Econ.
DOI 10.1007/s40953-016-0033-8

ORIGINAL ARTICLE

Determinants of Public Expenditure on Health in India: A Panel Data Analysis at Sub-National Level

Shailender Kumar Hooda[1]

Abstract This study explores whether political factors and fiscal capacity matter more in explaining the growth and variation in health expenditure than the state's income in India. The findings suggest that with the widening of political participation and greater representation of diverse population groups in politics, one can see a concomitant rise in government expenditure on health, indicating state interventionism in health sector for political reasons. Government's desire to increase health spending depends on the availability of financial resources with the states, failing which the probability of fulfilling expenditure obligations towards the sector would be low. In contrast to earlier estimates that income elasticity of health expenditure is nearly equal to or greater than one, the elasticity is found to be less than one which ranges between 0.16 and 0.59. Overall, coefficient estimates of most of these important covariates show an upward bias in terms of magnitude and precision due to the absence of unobserved control factors and of advanced robust estimation techniques.

Keywords Health expenditure · Political representation and participation · Fiscal capacity · Income elasticity · State's priority · India

JEL Classification I10 · I13 · I18

Introduction

Across the globe there is wide variation in the amount a country spends on health. Developed countries generally spend a sizable amount of public funds on health com-

✉ Shailender Kumar Hooda
skhooda.jnu@gmail.com; hoodask@isid.org.in

[1] Institute for Studies in Industrial Development (ISID), 4 Institutional Area, Vasant Kunj, New Delhi 110070, India

Published online: 12 March 2016

pared to the developing ones. For instance, per capita government expenditure on health in high income countries in 2012 was around USD 2857 (7.03 % of GDP and 16.8 % of the total budget spending), while in low income countries it was only USD 13 (1.98 % of GDP and 9.0 % of the total budget spending) (WHO 2015). Variation in health expenditure exists even in countries/regions with similar level of economic development like within OECD as well as the developing countries. A comparison shows that low income countries like Nepal and Bangladesh, whose per capita GDP (gross domestic product) is almost less than half of India's GDP, spend more public funds on health than India. Sri Lanka, also a developing country, allocates more public funds to health than India, reflecting that in addition to economic prosperity, other factors also matter in determining health expenditure.

In the last four decades, a number of studies have made attempts (1) to understand the general trends in health expenditure and its associated implications, and (2) to examine the degree to which discrepancy in health expenditure is explained by income and other confounding factors. Most of the studies have so far focused on examining the magnitude of income elasticity of health expenditure, especially in OECD countries; but, there are limited evidences in context of developing countries. Studies on the determinants of public spending have generally tried to reach a consensus on the issue of whether the health sector has been accorded highest priority amongst the goals for social and economic development of the country.

The present study continues along this line of research but differs from previous studies mainly in three ways. First, while many studies give evidence of the determinants of health expenditure at cross-country level, there is little systemic evidence available at the subnational level. Our study takes advantage of this and empirically examines the determinants of health expenditure by considering India as a case where subnational/state level information are taken as sample units. A subnational level case simply avoids the limitation of data aggregation—a methodological problem—when considering countries with different settings and varying levels of economic development in a single estimation. This takes care of the simple econometric assumption that data should be drawn from the same population, particularly to compare the sample units and to get robust estimates. Indian case is especially important because of its federal structure in nature. Though Indian states are governed under the same Constitution, but state government has the freedom to draft it own policies on subjects classified as state subjects. Health is a *state subject* in India. That is, health is the predominant responsibility of state governments. It is the state's responsibility to devise and implement comprehensive health policies—acknowledging the political and economic environment in the states—in order to meet the health needs of its population. Apart from socio-cultural, economic and political diversities, Indian states have several factors in common. Given the obligatory constitutional framework and social-economic-political diversity, one can expect variation in health expenditure across states. In order to have a broader understanding on the factors that explain the variation in health expenditure, a study at subnational level assumes important.

Second, many previous studies have largely focused on examining the discrepancy in health expenditure due to country's income, but how do state level political factors influence health expenditure have rarely been studied so far. This study attempts to

explain to what extent political factors have influenced growth and variation in health expenditure in Indian states.

Political factors generally shape public policy debates (Crepaz 1998; Vatter and Ruefli 2003). Within the political factors, the democratic election process creates an environment conducive for decision makers (political party) to gather appropriate and up-to-date information about the preferences and problems of the local people (Oates 1977). It is an effective channel for people to express their priorities and negotiate their wants, and a motivating environment for decision-makers to effectively address people's needs (Akin et al. 2001; Faguet 2004). People, through political participation, tend to influence and shape policies in their favour such as those related to welfare services including health (Besley and Coate 1997; Besley et al. 2005). Greater participation in the electoral process allows political authorities to align their decisions with the interests and priorities of the general public. This discussion allows us to hypothesize that with an increase in political participation of the population, one can see a concomitant rise in welfare expenditures like health. A detailed discussion on this variable is provided in the methodology section.

Third, as reflected in Abuja declaration, 2000, the government's desire to increase its spending on health highly depends on financial resources available with them. Low resource availability or any fiscal stringency can come in the way of fulfilling the obligations/commitment towards the expenditure on welfare activities. On the contrary, one can expect higher resource/budget allocation toward welfare services (including health) from states having high fiscal capacity, as more spending towards any sector requires more fiscal space (WHO 2010; Durairaj and Evans 2010). In order to understand the political economy of budget allocation for health sector, one has to put this phenomenon to empirical testing since it has hardly been studied so far (discussed in methodology section).

In addition, a variety of demand and supply side covariates of health expenditure have been advocated in previous studies. The present study explores, based on data availability and background literature, some other confounding socioeconomic and demographic factors that determine health expenditure in Indian states.

We believe that discrepancy in health expenditure across states is not solely because of state's income, but may depend on fiscal disabilities of arising from unequal capacities in raising revenues or due to varying costs of providing health services or political participation/representation or other demand and supply side factors. In order to fully understand, to the what extent these factors contribute in determining the health expenditure, the study has examined the following questions: (1) Does state income contribute to the growth and variation in health expenditure, (2) Do states with similar incomes follow the same trends, (3) Is political participation/representation a determining factor of health expenditure in Indian states, (4) How does the fiscal capacity of a state influence its health expenditure, and (5) What are the other supply and demand side factors that influence growth in health expenditure of the states.

The remainder of the paper is organized as follows. Next section briefly presents the background literature which is followed by the section on methodology and data sources along with the rationale for and limitations of variables selected for empirical examination. "Results" presents the descriptive statistics and results of the study. "Conclusion" summarizes the major findings and highlights some policy issues.

Background Literature

From last four decades,[1] health economists and applied econometricians have been tempted to analyze the determinants of the level of and growth in health expenditure. The first seminal work of Newhouse (1977) provided an important background for such work. Much of the discussion in literature is centered on whether the income of a country/region is the major determinant of health expenditure and if yes, whether income elasticity of health expenditure is lesser or greater than one. This research specifically focuses on measuring the income elasticity of total health expenditure and the associated policy implications for financing and distribution of healthcare resources. Health is either reported as a necessary good (if responsiveness is insensitive to income change, i.e. if elasticity <1) or a luxury good (if responsiveness is sensitive to income change, i.e. if elasticity >1). The second major concern in much of the literature related to the type of data and technique(s) to be used, variable(s) to select and method(s) to apply.

Income elasticity of health expenditure varies from greater than one to less than one across studies. Healthcare is reported as a luxury good (Newhouse 1977; Hitiris and Posnett 1992; Wilson 1999) while in others (Gerdtham 1998; Matteo and Matteo 1998; Bhat and Jain 2004; Sen 2005; Baltagi and Moscone 2010; Xu et al. 2011) as a necessary good. In some low and middle income countries, 'income' turned insignificant in influencing the public spending on health (Lu 2010). The advocates of 'health as a luxury good' argued that health is a kind of commodity that is best left to market forces. Whereas, advocates of 'health as a necessary good' often support the idea of greater government intervention in healthcare sector (Culyer 1988; Matteo 2003; Baltagi and Moscone 2010).

Among non-income factors, population age structure of those aged under 15 years and above 60–65 years (Leu 1986; Hitiris and Posnett 1992), epidemiological proxies like HIV prevalence, infant/maternal mortality rate and life expectancy (Lu 2010; Murthy and Okunade 2009; Dregen and Reimers 2005), technological progress and variation in medical practices like surgical procedures and number of specific medical equipments (Baker and Wheeler 2000; Weil 1995), health system characteristics like service provision (Gerdtham 1998), health financing sources like tax-based and social-insurance (Leu 1986; Hitiris and Posnett 1992; Gaag and Stimac 2008; Wagstaff and Bank 2009) and external funds (Gaag and Stimac 2008), provider payment mechanism (Gerdtham and Jönsson 2000; Murthy and Okunade 2009), country's fiscal capacity (Xu et al. 2011), and political factors (Vatter and Ruefli 2003) have been incorporated as covariates in many cross country/region studies. These factors, to a large extent, proved important in explaining the level of and growth in health expenditure, though results varies across studies.

For estimation process, studies have been carried out using cross-sectional bivariate (Newhouse 1977), cross-sectional multivariate (Leu 1986; Gerdtham and Sogaard 1992) regressions, panel data (static as well as dynamic) technique (Gerdtham and Sogaard 1992; Gerdtham 1998; Hitiris and Posnett 1992; Barros 1998; Roberts 1999;

[1] The studies like Gerdtham and Jönsson (2000), Baltagi and Moscone (2010) and Xu et al. (2011) provide a detailed literature on the issue.

Farag 2009; Xu et al. 2011), unit roots and cointegration analysis (Gerdtham and Löthgren 2002; Okunade and Karakus 2001; Hartwig 2008; Baltagi and Moscone 2010), while a few others applied the two-way causation and Granger-causality tests (Erdil and Yetkiner 2009).

An in-depth review reveals that there is no uniform consensus on how to proceed, what type of data to use, which method/technique to employ and which type of explanatory variables to include. The selection of variables and technique is generally guided by data limitations. For instance, health system characteristics such as health financing indicators, provider payment mechanisms and service provision have recently been recognized as important variables (Xu et al. 2011), but they could not be tested extensively in literature mainly due to data limitations. The empirical evidences and size of the coefficients thus depend on the selected data, variables and sample as well as the technique that one uses.

Data Sources and Methodology

Considering the fact that estimators are highly sensitive to the data, variables and method that one employs, the present study uses a single country as a case and obtains a set of rationally selected variables and techniques for estimation to avoid some of the aforementioned problems. Data on selected variables is taken into consideration for the period 1987–1988 to 2011–2012 for 16 major states of India.

Choice of Variables

Health expenditure Government expenditure on health (*he*) is one of the important component of healthcare financing. Therefore, state government expenditure on health is taken as dependent variable in the study. It includes state government expenditure on medical services, public health, family welfare, water supply and sanitation. This is taken in real per capita (at 1993–1994 prices) terms and its log value *(lnhe)* is used in the estimation. Data are compiled from Finance Account of individual states and RBI-State Finance: A Study of State Budget, Government of India

Income Many studies consider a country's/region's income (measured through per capita GDP) as the primary covariate to determine health expenditure. In this study, state income is considered as one of the determinants of health expenditure. In case of state income, it can be argued that as the per capita income increases, the pressure on the state machinery to provide better and varied health services increases. This may either be due to an increase in incidence of the so-called 'lifestyle' diseases such as diabetes, cancer and cardiovascular diseases, or the government as a 'welfare state' may spend more to provide comprehensive healthcare facilities across the regions. The government, in the face of its increased ability, may spend more on health to meet the increased demand for services. How far this phenomenon is reflected in the Indian scenario has been empirically tested. That is, it examines whether health expenditure grows with an increase in state income. The real per capita (at 1993–1994 prices) GDP of the sample states is taken as a measure of state income and its log

value (*lngdp*) is used in the analysis. Data are taken from National Account Statistics, Ministry of Statistics and Programme Implementation, Government of India. The size of coefficient of this variable tells whether income elasticity of health expenditure is greater than or lower than one.

Political factor The literature on political science, especially the 'power resource theory,' assumes that social classes are the main agents of societal change and that their balance of power determines policy outcomes. It states that the size of a welfare state can be explained in terms of power resources of social classes (Esping-Andersen 1990; Vatter and Ruefli 2003). One can expect an increase in welfare spending if more excluded groups (like the women and minorities) are incorporated into the political process through constitutionally mandated consensual rules (Gronbjerg 1977). Greater participation in the electoral process allows political authorities to align their decisions with the interests and priorities of the general public.

An effective political system in general 'empowers' the citizens by widening the access to political processes such as the introduction of various forms of proportional representation. It is believed that with an increase in political participation, government's expenditure on welfare activities will increase (Vatter and Ruefli 2003). In the present study we have presumed that when voter turnout is high, there is a concomitant rise in welfare expenditure.

In order to best understand the impact of political factors on welfare activities like health, we have followed a comprehensive approach that represents not only the total voter turnout, but also diverse categories like general, women and minority in the electoral process. Using such information, a comprehensive index of political participation (PPI) is constructed at state level through time. The indicators used for/to calculate PPI are: (1) percentage of total voter turnout in assembly election of a state, (2) total number of women who voted in assembly election as percentage of men who voted in assembly election, (3) percentage of women contestants in assembly election, (4) percentage of women contestants elected in assembly election of a state, and (5) women and reserved class panchayat representatives as a share of total panchayat representatives in a state. The Principal Component Analysis (PCA[2]) method is employed for constructing the PPI. We believe that this index will provide a better understanding of citizens' participation/representation as well as the level of democracy in a particular state and is also expected to influence government spending on health.

Data on these indicators has been taken from State Election Report of different states for various years. We have considered all state elections *years* for the study period (Table 1). Note that state assembly elections in India generally take place every five years. The index value therefore is kept constant for consecutive years in the panel data setting of a particular state. The log value of PPI (*lnPPI*) is used in the analysis.

[2] The PCA is a useful and well-known technique for summarizing multidimensional data. Its central idea is to reduce dimensionality of a data set. It summarizes and captures the variation in the data in the form of uncorrelated components (vectors), called principal components. The major advantage is that it gives greater weightage to those indicators that have high correlation with other selected indicators. The technique is often defended on the ground that better correlated indicators should be the target of policy intervention because of their apparent potential to bring about substantial changes through their impact on other indicators (Kundu 1984).

Table 1 Extent of political participation across states

State	Election years data used for PPI	PPI value		
		1987–1988	2000–2001	2011–2012
Andhra Pradesh	1985, 89, 94, 99, 04, 09	3.11	4.83	5.38
Assam	1985, 91, 96, 01, 06, 11	3.33	3.39	5.14
Bihar	1985, 90, 95, 00, 05, 10	2.42	3.28	5.49
Gujarat	1985, 90, 95, 98, 02, 07, 12	4.33	3.24	4.37
Haryana	1987, 91, 96, 00, 05, 09	3.37	3.58	3.65
Himachal Pradesh	1985, 90, 93, 98, 03, 07, 12	3.96	4.92	4.51
Karnataka	1989, 94, 99, 04, 08, 12	3.58	3.51	3.82
Kerala	1987, 91, 96, 01, 06, 11	4.08	4.40	4.86
Madhya Pradesh	1985, 90, 93, 98, 03, 08	3.00	4.11	5.09
Maharashtra	1985, 90, 95, 99, 04, 09	3.21	3.52	3.69
Orissa	1985, 90, 95, 00, 04, 09	2.76	4.28	4.55
Punjab	1985, 92, 97, 02, 07, 12	3.29	4.25	5.24
Rajasthan	1985, 90, 93, 98, 03, 08, 12	3.23	3.78	5.20
Tamil Nadu	1989, 91, 96, 01, 06, 11	4.82	3.41	4.50
Uttar Pradesh	1989, 91, 93, 96, 02, 07, 12	2.98	2.80	4.60
West Bengal	1987, 91, 96, 01, 06, 11	3.28	3.66	5.33

Source: estimated using data from http://eci.nic.in/eci_main1/ElectionStatistics.aspx

A significant and positive coefficient value reflects that a high participation rate across diversified groups in electoral process influences the growth of government spending on health.

The descriptive statistics of PPI indicators and values presented in Tables 1 and 2 show that within India, there is wide variation across states, indicating differential rates of political participation/representation. The electoral participation rate shows an increasing trend over the period in most of the states (Table 1 and Appendix 1).

Fiscal capacity Fiscal capacity (*fc*) generally refers to the revenue generating capacity of the government. Inclusion of this variable is based on the notion that a high revenue generating capacity ensures greater autonomy to the government to meet the growing expenditure obligations/requirements for the provisioning of different welfare services, including health. Therefore, to measure the fiscal capacity variable, total government expenditure was taken as a share of GDP in the study by Xu et al. (2011). This share reflects the fiscal space for a given GDP level. But we believe that, as referred to in the report of the Finance Commission of India (GOI 2013), a state's own revenue resources or revenue generating capacity (either take in per capita term or as a share of GDP or share in total expenditure of the state) is the best measure of fiscal capacity of the state than the variable used in the previous studies. In the present study, per capita total own (tax plus non-tax) revenue of a state is considered as an indicator of fiscal capacity. This reflects the availability of resources with the state

Table 2 Descriptive statistics of components of political factor

Variables		Mean	SD	Min	Max	% diff.	Obs.
% of total voters' turnout	Overall	65.5	9.3	23.8	84.3	−71.8	400
	Between		7.0	52.4	77.4	−32.3	16
	Within		6.4	29.0	83.4	−65.2	25
% of women voted to men voted	Overall	84.9	10.1	57.2	108.0	−47.0	400
	Between		9.3	70.2	103.0	−31.8	16
	Within		4.7	64.8	105.7	−38.7	25
% of women contested	Overall	4.9	2.2	0.0	10.0	−100.0	400
	Between		0.8	3.9	6.5	−40.0	16
	Within		2.1	1.6	9.9	−83.8	25
% of contested women elected	Overall	6.2	3.0	1.1	14.0	−92.1	400
	Between		1.7	3.1	10.0	−69.0	16
	Within		2.5	0.0	15.8	−100.0	25
% of elected women/minority groups in PRIs		30.3	5.5	22.4	40.1	−44.1	16/400

Source: same as Table 1

governments to meet their expenditure obligations, thus providing greater autonomy to spend according to their priorities. Since health is a state subject, we presumed that the health spending of a state will increase with the strengthening of its fiscal capacity. That is, a state will allocate a large amount for health funds if more resources are available with them, whereas a state with low resource capacity will find it difficult to fulfill the expenditure obligations/commitments to a particular sector. This presumption is based on the notion that more spending in health requires more fiscal space (WHO 2010; Durairaj and Evans 2010). This variable is used as log of per capita state own revenue *(lnfc)* in the analysis. The data is taken form Economic and Political Weekly Research Foundation (EPWRF) Online Services on India Time Series.

Demographic Characteristics: Within the demographic characteristics, population age structure was expected to influence health expenditure. Therefore, age was more often used as a covariate of health expenditure in earlier estimations. Generally, the shares of the young (under 15 years of age) and/or old (above 60, 65 or 75 years of age) people in the total population are the most commonly used indicators. The notion behind the use of these indicators is that these two age groups use more healthcare services. For instance, in countries where population ageing is fast approaching, their health systems face high pressure to cope with increasing needs of the population (Xu et al. 2011). This phenomenon, however, may be true for countries (especially high income ones) where either the elderly population is high or population ageing is fast approaching. The same may not be true for a developing country like India where ageing is not a dominant issue or a deciding factor for increasing government

spending. Therefore, one would not expect the government to redirect or increase its spending on health with an increase in elderly population.

We believe that India's demographic structure poses a different challenge to its health system compared to other developed and developing nations. One can envisage that the changing epidemiological profile of India, especially the rising burden of non-communicable diseases (NCDs), along with a high load of communicable diseases, presents a formidable challenge to the country's healthcare system. According to WHO (2011), NCDs were responsible for 53 % of deaths in India in 2008. Evidence suggests that the highest proportion of NCD deaths occur in the productive years of life (i.e. under the age of 60 years). Alongside the double burden of diseases, in 2013, the infant mortality rate (IMR) of India was around 41.4 whereas that of Sri Lanka's was 8.2. The life expectancy at birth (about 66) of an average Indian is at least 13 years lower than that in high income countries and even lower than of Sri Lanka (about 79 years) (WHO 2015). According to the World Development Report (2009), almost half of Indian children suffer from malnutrition, which is worse than the situation in some countries in Sub-Saharan Africa (World Bank 2009). The latest National Health and Family Health Survey-3 of India reported that more than 50 % of women suffer from anemia (GOI 2007). There is still a huge gap in rural-urban health outcomes. Further, an increase in the incidence of the so-called 'lifestyle' diseases also poses various challenges. This reflects that the population count, across age groups, poses great challenge to the country's healthcare system. In such a situation, it becomes important for India to improve its overall healthcare system in order to provide comprehensive healthcare facility to the general population. This is even more important because there is shortfall in the provisioning of basic health services across states (GOI 2012). Therefore, instead of considering the age structure of a particular population, including the overall population density in a region/state will be more useful, as each age group requires different types of healthcare facilities. We have presumed that state feels immense pressure to provide health services of the requisite level to its entire population. Therefore, overall population density (*pd*) is taken as a covariate of health expenditure and its log value (*lnpd*) is used in the analysis. The data is compiled from Census of India, Government of India.

Mortality and morbidity challenges The mortality, morbidity or epidemiological profile of a country/state generally reflects the diseases and health problems that need to be addressed through an efficient health system. Various proxies of such need factors like HIV prevalence (Lu 2010), TB incidence (Xu et al. 2011) and maternal mortality rate (Murthy and Okunade 2009) have been used as covariates of health expenditure in literature. In the present study infant mortality rate (IMR) is taken as a proxy of need factors. We believe that infant mortality is superior and a more reliable measure than other health indicators like life expectancy. While infant mortality figures are based on actual data, life expectancy figures are based on extrapolations from child mortality data. The IMR also reflects the health status of both the mother and the child in a country/state. We have presumed that the government is more sensitive to IMR than other mortality and morbidity indicators. The log value of IMR (*lnIMR*) is used in the analysis. The data are explored from Sample Registration System, Office of the Registrar General, Government of India.

It is important to note that there is no theoretical understanding on whether the coefficient signs for demographic and mortality indicators are positive or negative. In simple terms, one can argue that a less healthy population will, on average, require more resources and thus result in greater demand for healthcare and an increase in per capita health expenditure. On the contrary, states may have ensured better outcomes through high spending, reflecting two-way causation problem in the model. Therefore, we do not strongly support the signs of the coefficients of these indicators.

Health—a state priority? The level of priority accorded to the health sector by the states is not easy to measure. The notion of whether health sector has been given priority by the state is captured from previous study, Hooda (2013). These studies estimated the trend growth rates across states by dividing their study period—based on macroeconomic conditions—into different subperiods. They reported that some of the adverse macroeconomic changes have not only affected the overall public finance, but also affected the overall public spending in general and on health sector in particular of many states. High spending on health in adverse conditions is referred to as 'high priority' accorded to health sector by the respective state government, otherwise it is referred to as 'low priority'. Using this connotation, we have derived state priority indicators in diatomaceous (dummy) form. We have assigned value 1 for states that managed to sustain a positive trend in health expenditure during adverse fiscal stringency period, and 0 otherwise. For fiscal stringency and/or adverse macroeconomic periods one may refer to the above-mentioned two studies. The overall purpose to include this variable is to measure the growth in health spending of states that accord high priority to health compared to others. The state's priority (*sp*) is used as dummy variable (1-high priority, 0-otherwise) in the analysis.

In addition, state specific dummy variable is introduced, particularly to see 'whether states with the same level of economic development follow the same trends when increasing health spending'. The notion provided in National Rural Health Mission (NRHM) document for state classification is used (Government of India 2005). In the NRHM document, states are classified as high-focused states (HFS) having high fertility and mortality rates and others as non-HFS. Using this classification, a dummy variable is used, assigning value 1 for high-focused states and 0 otherwise. Of the total sample, Assam, Bihar, Madhya Pradesh, Orissa, Rajasthan and Uttar Pradesh (except for Himachal Pradesh) were termed as high-focused states. Incidentally, the per capita income of these states was also low compared to the others. The results are also interpreted by level of development.

Estimation Procedure

The study employed data from 16 major states of India covering the period from 1987–1988 to 2011–2012. This sample consists of a balanced panel data with 400 observations covering 25 time-series and 16 cross-section units. The panel data allows us to control and test for cross and time-invariant effects and to conduct appropriate analysis in the presence of those invariant effects (Baltagi 2013; Greene 2008). The specification of estimated panel equation is as follows:

$$lnhe_{st} = \beta_0 + \beta_1 lnsgdp_{st} + \beta_2 lnPPI_{st} + \beta_3 lnfc_{st} + \beta_4 lnIMR_{st} + \beta_5 lnpd_{st} + \beta_6 spd_{st} + \beta_7 scd_{st} + v_s + \varepsilon_{st} \ldots \quad (1)$$

where, *lnhe* is the log of real per capita public expenditure on health, *lnsgdp* is the log of real per capita State's GDP representing state's income, *lnPPI* is the log of the extent of political participation/representation in a state, *lnfc* is the log of real per capita state**'s** own revenue representing fiscal capacity of a state, *lnIMR* is the log of infant mortality rate, *lnpd* is the population density in a state, *sdp* is dummy variable reflecting state's priority to the health sector, *sdp* is dummy of state classification into high-focused and non-high focused states, *vs* is state specific residual, εst is standard residual with the usual assumption of zero mean, uncorrelated with v and other explanatory variables, and homoscedasticity, *s* is state (16 states), and t is time from 1987–1988 to 2011–2012 (25 years).

The above equation, however, can be estimated employing pooled OLS estimators by simply stacking the data over *s* and *t* into one long regression with NT observations. The usual OLS output treats each of the *t* years as independent pieces of information, but there is minimal information, given the positive error correction. This leads to an overstatement of estimator precision, which can be very large. Therefore, one needs to use panel-corrected standard errors whenever OLS is applied in a panel setting. But, it is important to note that the OLS estimators will be inconsistent if the true model is a fixed effects model (Cameron and Trivedi 2005). In such a situation, it becomes important to choose between a fixed effects (FE) model and a random effects (RE) model.

The RE specification helps us to gauge the impact of different covariates as they change across states, while the FE model measures the impact of a change in any of these variables within a state. The Hausman specification test is applied to choose between FE and RE models. The Hausman test {Ho: difference in coefficients not systematic, [chi^2(6) = $(b - B)'[(V\_b - V\_B)\hat{}(-1)](b - B)$ = 36.29; Prob > chi^2 = 0.00] estimates show significant differences in the coefficients estimated by the consistent FE estimators and efficient RE estimators, therefore FE Model is more appropriate (Appendix 2). That is, exogeneity of the regressors with respect to the time-invariant error terms was rejected, leading us to consider the FE model. In addition, a simple descriptive statistics (presented in Table 3) shows relatively high within-variance in many of the independent variables, suggesting a low statistical efficiency of the RE model.

In order to ensure robust results and minimize the potentially confounding effects of unobserved state-specific attributes, the FE model is employed in the present study. Note that in this case even though the OLS estimators are inconsistent, the results are reported in the study, specifically to see the changes in the size of income elasticity and other coefficient values.

It is important to note that even after controlling for time-invariant country fixed effects, the residual may contain time-varying factors that may be correlated with explanatory variables, which may lead to biased estimates for the coefficients. The FE model assumes that independent variables are strictly exogenous. Resultantly, its estimates will be inconsistent with models having endogenous variables and/or lagged

Table 3 Descriptive statistics of selected variables across space and time

Variable		Mean	SD	Min	Max	% diff.	Obs.
PCHE	Overall	192	124	66	887	−92.6	400
	Between		112	89	580	−84.7	16
	Within		59	15	498	−97.0	25
lnPCHE	Overall	5.12	0.48	4.19	6.79	−38.3	400
	Between		0.43	4.46	6.33	−29.5	16
	Within		0.25	4.59	5.91	−22.3	25
PCSGDP	Overall	12,875	7006	3034	38,571	−92.1	400
	Between		4402	4905	19,424	−74.7	16
	Within		5556	2926	32,022	−90.9	25
lnPCSGDP	Overall	9.33	0.52	8.02	10.56	−24.1	400
	Between		0.37	8.45	9.81	−13.9	16
	Within		0.37	8.64	10.21	−15.4	25
PCFC	Overall	1175	706	221	3514	−93.7	400
	Between		530	343	2028	−83.1	16
	Within		484	220	3075	−92.8	25
lnPCFC	Overall	6.88	0.63	5.40	8.16	−33.8	400
	Between		0.52	5.82	7.57	−23.1	16
	Within		0.37	6.20	7.89	−21.4	25
IMR	Overall	63	23	10	127	−92.1	400
	Between		19	15	93	−83.9	16
	Within		13	26	105	−75.2	25
lnIMR	Overall	4.05	0.47	2.30	4.84	−52.5	400
	Between		0.43	2.68	4.51	−40.6	16
	Within		0.22	3.31	4.71	−29.7	25
PPI value	Overall	3.88	0.70	2.42	5.49	−55.9	400
	Between		0.42	3.16	4.48	−29.5	16
	Within		0.56	2.56	6.21	−58.8	25
PD	Overall	399	227	87	1014	−91.4	400
	Between		227	107	877	−87.8	16
	Within		54	231	577	−60.0	25
lnPD	Overall	5.82	0.59	4.47	6.92	−35.4	400
	Between		0.59	4.66	6.77	−31.2	16
	Within		0.13	5.54	6.09	−9.0	25

Source: author's estimates

dependent variables as regressors. In our case, 'state priority' dummy is derived from the dependent variable and is therefore endogenous in nature. Moreover, government's budgetary allocation for health sector (the dependent variable) generally depends on the amount allocated during the previous year. That is, current year fund allocation depends on what the government had allocated in the previous year's budget. Thus,

the introduction of lagged dependent variable in the analysis assumes importance. The models with lagged dependent variable, which is correlated with the fixed effects, produce biased coefficient estimates. In order to provide efficient estimates, a dynamic panel set by Arellano-Bond is estimated using a Generalized Method of Moments (GMM) approach. The Arellano-Bond estimator corrects for the endogeneity in the lagged dependent variable and provides consistent parameter estimates even in the presence of endogenous independent variables (Cameron and Trivedi 2005). It also allows for individual fixed effects, heteroskedasticity and autocorrelation within individuals.

The first step of the GMM procedure is to remove the individual effects by introducing instrumental variable(s) of endogenous regressors. Finding valid external instruments, however, is not an easy task. One of the main advantages of the GMM approach is that it draws instruments from within the dataset, as lagged value of the instrumented/dependent variable. The normality assumption tests the exogeneity of instruments using the Sargan test. The GMM procedure therefore gains efficiency compared to OLS by exploiting additional moment restrictions. The estimated dynamic panel equation is as follows:

$$\begin{aligned} lnhe_{st} = \alpha + \beta_0 \mathrm{lnhe}_{st-1} + \beta_1\, lnsgdp_{st} + \beta_2 ln\,PPI_{st} + \beta_3 lnfc_{st} \\ + \beta_4 lnIMR_{st} + \beta_5\, lnpd_{st} + \beta_6 spd_{st} + \beta_7 scd_{st} + \upsilon_s + \varepsilon_{st} \ldots \end{aligned} \quad (2)$$

The $lnhe_{st-1}$ is the lagged dependent variable. The other variables have already been defined in Eq. 1. In the dynamic model, the Sargan test (H0: over identifying restrictions are valid) shows that the population moment conditions specified in the model are correct. Estimates show that the H0 is not rejected, because Prob-value turned out to be (Prob $>$ 0.05) in all estimations (see Table 5). The Arellano-Bond (H0: no autocorrelation) test for zero autocorrelation in first-differenced errors shows that the abond serial correlation test with 1st lag significant and 2nd lag insignificant tells us that the model is correctly specified at lag one (for detail, see note of Table 7).

Results

Preliminary Findings

Table 3 summarizes cross-state and time-series variation in data/variables used in the analysis. The percentage difference between minimum and maximum values of dependent variable shows greater time-series (within) variation (97 %) compared to the cross-sectional (between) variation (85 %). Similarly, percentage difference between the minimum and maximum values is found to be high in time-series compared to the cross-sectional variation in covariates like per capita income, fiscal capacity and political participation in the electoral process. On the contrary, cross-sectional variation is found to be greater in infant mortality rates and population density as compared to their time-series differences in the maximum and minimum values.

The dependent variable (per capita health expenditure) and all covariates (income, fiscal capacity, population density, infant mortality rates and political participation)

Table 4 Inter-state variation in per capita public expenditure on health (in Rs)

	1987–1992	1993–1998	1999–2004	2005–2011
Kerala	146	135	164	236
Tamil Nadu	198	204	247	243
Maharashtra	131	141	178	195
Punjab	151	148	199	243
West Bengal	88	95	129	135
Karnataka	130	142	183	205
Himachal Pradesh	427	460	602	797
Gujarat	164	170	223	211
Andhra Pradesh	113	176	198	195
Bihar	69	80	94	108
Haryana	146	184	221	336
Rajasthan	200	227	252	267
Assam	139	106	124	250
Orissa	102	110	128	169
Uttar Pradesh	86	79	83	149
Madhya Pradesh	120	149	180	175
Mean	150	163	200	245
STDEV	82.3	90.0	118.6	157.5
COV	0.55	0.55	0.59	0.64

Source: Finance Account of individual states and RBI-State Finance: A Study of State Budget

have more or less shown an upward trend during the study period in most of the states (see Appendices 1, 3 to 5). But there remains a considerably high variation across states. There exists high inter-state variation in per capita public expenditure on health, the dependent variable. The variation in health expenditure across these states has increased from 0.55 during the subperiod 1987–1988 to 1992–1993 to 0.64 during the last subperiod 2005–2006 to 2011–2012 (Table 4).

A closer examination of Table 5 reveals wide variation in per capita spending across states. It reveals that states like Tamil Nadu, Kerala, Himachal Pradesh and Punjab allocate a sizable amount of public funds for health sector and consequently their health outcome (like IMR) is better compared to the other states. As for Assam and Haryana, despite spending a good amount of money on health, they could not manage better health outcomes. Some of the low income states (Bihar, Orissa and Madhya Pradesh) spend low amount on health; thus, there health outcomes are also poor. West Bengal and Maharashtra, on the other side, ranked low in per capita health spending but secured good outcomes. It seems that the variation in health expenditure is not because of the preferences of individual states or because of prevailing mortality burden in the state. Some high income states allocate low funds to the health sector despite high prevalence of mortality burden. Thus, the differences in health expenditure/spending may not only be attributed to a state's income. It could be because of state's interest in promoting the sector and/or fiscal disability arising from unequal revenue-raising

capacity or due to varying cost of providing health services. Regional diversity, socio-economic conditions and demographic characteristics of a particular state, however, can also contribute to inter-state variation in health expenditure.

Empirical Results

One of the major objectives of the study is to examine whether growth and variation in health expenditure is caused by income and/or political factors and fiscal capacity of the states. A simple correlation matrix of the relationship between these variables shows that movements in per capita health expenditure appear to be positively correlated with the trends in per capita income (Table 6). Also, health expenditure is positively correlated with fiscal capacity of the states and level of political participation. The trends in IMR are negatively correlated with health expenditure, indicating that states which spend a low amount on health have the least healthy population. The demographic (population density) characteristic also shows negative association with health expenditure. On average, health spending in low income (high focused) states is lower compared to their counterparts. Nevertheless, the costs of providing basic health services and tackling the increasing burden of disease/mortality are very high in these states. The simple correlation matrix, however, does not tell which factors matter most in determining the growth and variation in health expenditure. The results of the empirical investigation are presented in Table 7.

Table 7 shows that the coefficient values of the impact of per capita income decline in magnitude and precision with the inclusion of other possible determinants of per capita health expenditure. With the inclusion of all other covariates of health expenditure, the OLS coefficient estimates for income fell by 47 %. The coefficient value of income declined from 0.59 to 0.44 and 0.35 respectively with the inclusion of political factors and state's fiscal capacity separately in the OLS estimation. The coefficient further fell to 0.312 after inclusion of all other covariates of health expenditure in the analysis.

In case of magnitude estimation, the empirical estimates fall in value when one moves towards a more advanced robust technique, say from pooled (OLS) to panel (FE) and then to dynamic panel (GMM) estimation. In the fixed effects estimate, the magnitude of income elasticity (FE-1 to FE-4) fell by 39 %. This decline in coefficient value was 26 % with the use of dynamic panel GMM estimates, indicating a decline in the magnitude of coefficient with the inclusion of other observed determinants. A comparison of model-1 across different (OLS, FE, GMM) techniques shows that the income elasticity coefficient fell from its benchmark OLS estimate value of 0.59 to 0.21 in the dynamic panel, indicating GMM coefficient decline by 64 % compared to the corresponding OLS estimates. Similar comparison of Model-4, which includes all observed covariates in the equation, reveals that the GMM coefficient declined by 50 % as compared to the usual OLS estimates of income elasticity.

The elasticity estimates, across different estimators, remained significant at one % in influencing the growth in health expenditure. The income elasticity of health expenditure ranges between 0.16 and 0.59 across these estimations, which is less than one. Thus, in contrast to the findings of equal to or greater than one, income elasticity in the Indian context turned out to be less than one. These empirical results suggest

Table 5 Summary statistics of selected variables at state level

States	Real PCHE (Rs)		Real PCSGDP (Rs)		Real PCFC (Rs)		Pop. Density (km^2)		IMR (/1000 live birth)	
	1987–1988	2011–2012	1987–1988	2011–2012	1987–1988	2011–2012	1987–1988	2011–2012	1987–1988	2011–2012
Andhra Pr.	134	230	6948	25,357	815	2463	225	310	79	43
Assam	156	301	6185	17,892	360	1552	278	393	102	55
Bihar	66	146	4254	9536	326	515	463	787	101	44
Gujarat	185	257	7952	28,601	964	2632	199	308	97	41
Haryana	157	452	10,159	35,549	1368	2939	343	581	87	44
Himachal Pr.	413	704	7087	29,488	720	2847	87	124	82	38
Karnataka	145	247	6875	23,380	839	2495	222	312	75	35
Kerala	140	315	6482	31,044	754	2774	723	893	28	12
Madhya Pr.	133	232	6254	17,530	603	1828	137	222	120	59
Maharashtra	140	225	9475	38,571	1105	2976	237	369	66	25
Orissa	106	181	4840	19,050	345	1549	191	271	126	57
Punjab	149	338	12,190	32,981	1124	3196	376	587	62	30
Rajasthan	198	277	5285	15,519	552	1386	119	200	102	52
Tamil Nadu	163	339	7440	34,296	740	3514	414	521	76	22
Uttar Pr.	82	167	5304	13,060	405	1223	439	723	127	57
West Bengal	81	162	6328	17,494	411	898	709	1014	71	32
States' avg.	153	286	7066	24,334	714	2174	323	476	88	40

Source: author's design

Table 6 Correlation matrix between selected variables

	lnpche	lnpcsgdp	lnpcfc	lnPPI	lnimr	lnpd	spd	scd
Lnpche	1.000							
lnpcsgdp	0.631	1.000						
lnpcfc	0.624	0.625	1.000					
lnPPI	0.547	0.549	0.456	1.000				
lnimr	−0.262	−0.543	−0.486	−0.472	1.000			
lnpd	−0.447	0.067	−0.033	0.047	−0.497	1.000		
spd	0.200	0.350	0.269	0.297	−0.290	0.170	1.000	
scd	−0.047	−0.516	−0.570	−0.185	0.513	−0.406	−0.323	1.000

Source: author's estimates

that health is not a luxury good; rather, it is a necessary good. Similar observations are reported by Sen (2005) from OECD data.

The OLS coefficient estimate of income elasticity, however, shows little 'high' value compared to other advanced robust techniques. Here it becomes important to highlight that the results obtained from this technique may be biased. Further, because some of the explanatory variables included in the model are not exclusively exogenous, it could result in correlation with the error term and thus provide inconsistent estimates. Consequently, OLS estimates will be biased. In panel setting, even if one uses panel-corrected standard errors while applying OLS, the estimates will still be inconsistent if the true model is a fixed effects model. As reported in the methodological section, the FE model is more suitable for our study. Therefore, we do not place much emphasis on results obtained from OLS estimation technique. One can see from Table 7 that the FE estimates of income elasticity are again lower than one (ranges between 0.52 and 0.32), indicating that health is a necessary good. These low income elasticity estimates allow us to argue that the public health sector has not been given high priority amongst the goals for social and economic development of the country.

The level of priority accorded to the health sector in Indian states can be gauged from the association between health expenditure and level of development presented in Fig. 1. In general economics parlance, as income increases, the government, as a welfare state, also increases its spending on critical sectors like health. Country experiences (Part-1) confirm that high income countries allocate more public funds for health sector out of their total income. That is, fund allocation for health sector increases with the level of economic development of a country. Similar trends, however, are not observed in the Indian case (Part-2). High income states even allocate low public funds towards health out of their income, indicating that state spending in India is not consistent with economic theory. Thus, as mentioned earlier, it strengthens our case that public health is not a high-priority goal for socio-economic development of India.

Greater participation of diverse groups in the electoral process leads to a significant rise in government spending on health. The size of the coefficient for political factors turned out to be higher (0.57) than the income elasticity coefficient in the OLS estimation, when considering all confounding factors in the equation (OLS-4). Its coefficient

Table 7 Regression results: OLS, FE, GMM estimates

	Pooled regression: OLS estimate				Panel regression: FE estimate				Dynamic panel regression: GMM estimate			
	OLS-1	OLS-2	OLS-3	OLS-4	FE-1	FE-2	FE-3	FE-4	GMM-1	GMM-2	GMM-3	GMM-4
Lnhe.L1									0.703***	0.698***	0.699***	0.679***
									(0.035)	(0.035)	(0.035)	(0.037)
lnsgdp	0.59***	0.44***	0.349***	0.312***	0.52***	0.437***	0.422***	0.317***	0.21***	0.195***	0.175***	0.156**
	(0.036)	(0.041)	(0.094)	(0.074)	(0.0208)	(0.026)	(0.052)	(0.068)	(0.024)	(0.029)	(0.045)	(0.059)
lnPPI		0.76***		0.571***		0.331***		0.191**		0.063		0.097*
		(0.12)		(0.089)		(0.068)		(0.076)		(0.071)		(0.073)
lnfc			0.212***	0.141**			0.108***	0.152**			0.041	0.045
			(0.078)	(0.063)			(0.053)	(0.052)			(0.043)	(0.046)
lnimr				−0.237***				0.334***				−0.022
				(0.041)				(0.076)				(0.064)
lnpd				−0.425***				0.632***				−0.11**
				(0.0299)				(0.143)				(0.046)
scd				0.190***								−0.016
				(0.0378)								(0.057)
spd				0.0516*				0.0208				0.057**
				(0.028)				(0.018)				(0.018)
Adj-R^2	0.396	0.453	0.406	0.7314	0.3984	0.4423	0.4071	0.5443				
M1: z (p > z)									−3.419	−3.429	−3.408	−3.403
									(0.0006)	(0.0006)	(0.0007)	(0.0007)
M2: z (p > z)									1.3803	1.378	1.3402	1.1504
									(0.1675)	(0.1682)	(0.1802)	(0.2500)
Sargan:chi^2 (P > chi^2)									305.0 (0.0701)	304.5(0.072)	304.9 (0.071)	304.2 (0.068)
									(0.0701)	(0.072)	(0.071)	(0.068)

***, **, * are 1, 5, 10 % significance level. Total observations (N) are 400 (n = 16, t = 25); Lnhe.L1 is lag value dependent variable (he)

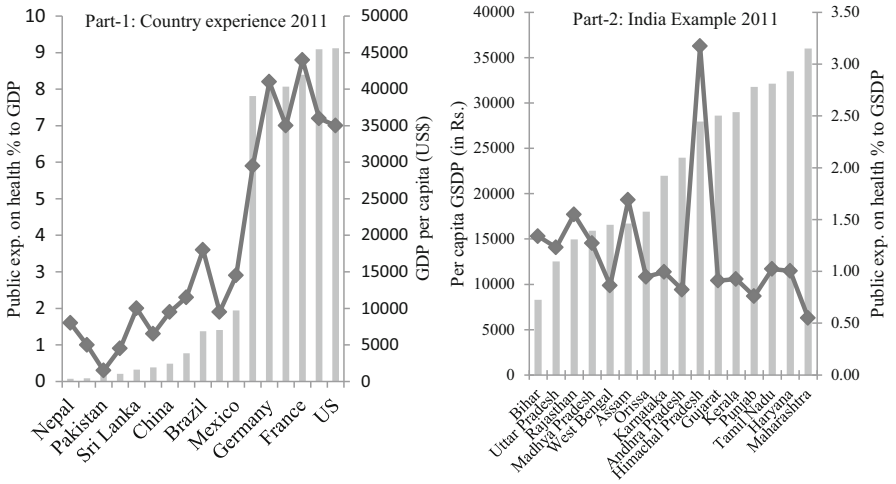


Fig. 1 Health expenditure and level of development relationship source: author's design using data from WHO 2013, 2015 (Part-1) and Finances of State Governments retrieved from http://www.epwrf.res.in (Part-2)

value, however, was slightly lower than the coefficient of income in both FE (0.19) and GMM (0.097) estimation, but remained statistically significant with a positive sign. This reflects that with an increase in political participation/representation, there is a concomitant rise in welfare spending like health across states of India. In other words, greater participation in the electoral process allows political authorities to align their decisions with the interests and priorities of the general public. Thus, one can argue that political factors do matter in determining public spending on health. That is, one can expect an increase in welfare spending if, overall, more excluded groups are incorporated into the political process through constitutionally mandated consensual rules. This is important in the public policy discourse, particularly for ensuring state interventionism in welfare activities like providing of health services.

It is true that the government's desire to increase health spending mainly depends on the availability of financial resources. The fiscal capacity of a particular state turns significant in positively influencing public health expenditure. The coefficient value (0.15) of fiscal capacity variable turns significant at 5 % level in FE estimation, while positive but insignificant in the GMM estimation. This indicates that higher the fiscal capacity (an indication of high resource availability and autonomy with the state governments), higher will be the government spending on health. Low resource availability or fiscal stringency can come in the way of fulfilling the expenditure obligations/commitments for providing better health services in the country. This is in line with the argument that high resource allocation towards any sector requires more fiscal space with the government. In order to meet the expenditure obligation for any particular sector, states will have to focus on generating revenue from their own sources, either through widening the tax base or by improving the administrative and technical efficiencies for resource collection. An increased fiscal capacity not only provides autonomy to allocate resources to different sectors, but also reduces fiscal dependency on central transfers.

The coefficient estimates of demographic factors like population density and infant mortality rate are negative and significant in OLS estimation, while they turned positive and significant in FE estimation. The former, however, turned negatively insignificant in the dynamic panel estimation, while latter was negatively significant. Coefficient estimates of these variables have remained inconclusive in our analysis.

The coefficient value of government priority variable turned positive and significant, indicating that the health sector is given significant priority in states that have managed to sustain growth/trend even in times of fiscal stringency and/or under adverse macroeconomic conditions as compared to their counterparts.

The estimates from dynamic panel show that the coefficient value of lag dependent variable turned out to be high and significant at 1 %. This indicates that in addition to other factors, policy decisions taken in the past (for instance, previous year's budget allocation for various health schemes) define, to a considerable degree, the future path of policy development and the level of state interventionism in the health sector.

One important finding of the study is that the coefficient estimates of most of the important covariates show an upward bias in magnitude and precision due to the absence of unobserved control determinants of per capita health expenditure and an advanced robust estimation technique.

The findings of this study, however, do not rule out the possible confounding effects of simultaneity bias in the estimation. One can evaluate the sensitivity of empirical estimates through the inclusion of more/other confounding factors and instruments/techniques, etc. But, as per objective, this study has reassessed the elasticity estimates with robust samples and techniques and also added new dimensions such as establishing the importance of political factors and fiscal capacity in public policy discourse, which is the strength of the present study. The results of elasticity estimates are more or less consistent with the other study estimates on developing countries/regions.

Conclusion

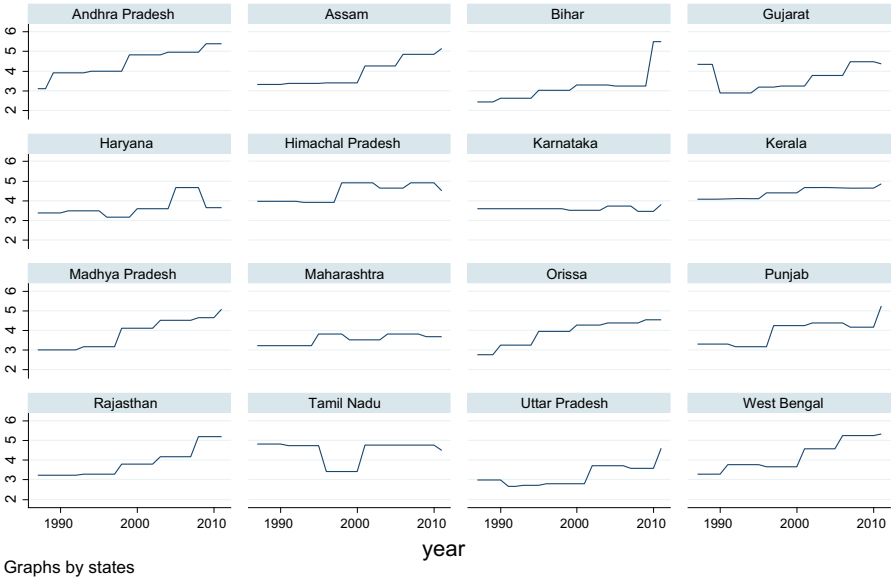
In contrast to the estimates of previous studies that income elasticity of health expenditure is equal to or greater than one, this study suggests that income elasticity ranges between 0.16 and 0.59. No doubt, higher income contributes to higher public spending on health, but having a coefficient value of less than one indicates that health is a necessary good. The low income elasticity estimates indicate that public health sector has not been given high priority amongst the goals for social and economic development in the country. Further, with the widening of access to political participation and representation of diverse population groups one can see a concomitant rise in government spending on health, indicating that state intervention in welfare activities increases with political participation. More interestingly, if, on average, political participation/representation of diverse population groups is high in any state, then spending on health is also likely to be high even if state's income is low. In that sense, political participation assumes greater significance in influencing the government to allocate more funds to health sector amongst the other economic development services/sectors of the state.

The government's desire to increase health spending is highly dependent on the availability of financial resources with the states, failing which the probability of fulfilling expenditure obligations towards the sector may be low. The results on demographic and mortality factors, however, remain inconclusive. Overall, we noticed that the coefficient estimates of most of the important covariates are biased upward in magnitude and precision due to the absence of control for unobserved determinants and of an advance robust estimation technique.

It is important to note that the inclusion or exclusion of more/other confounding factors and instruments/techniques, etc, may influence the results. Therefore, this study concludes that no approach/study/technique in itself represents the whole truth, but each study is a grain-sized contribution to the estimation process. However, given the diverse nature of explanatory variables and techniques used, this study has added new dimensions: establishing how political participation and fiscal capacity variables matter in influencing public policy, particularly government expenditure on welfare activities like health services. Our results on elasticity estimates are more or less consistent with those of many previous studies.

Acknowledgments I sincerely thank the anonymous referee for helpful comments on the earlier version of the paper and Puja Mehta for proof reading. The useful comments and suggestions received from the faculty members of the Institute for Studies in Industrial Development are duly acknowledged. However, views expressed in the paper are those of mine.

Appendix 1: Extent of Political Participation/Representation Across States of India

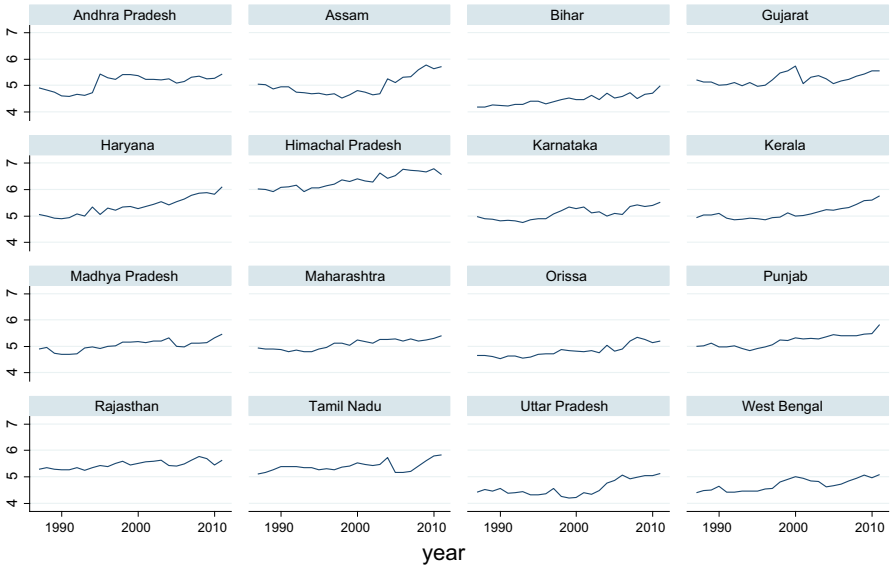


Appendix 2: Choice Between FE and RE Models: The Hausman Test Result

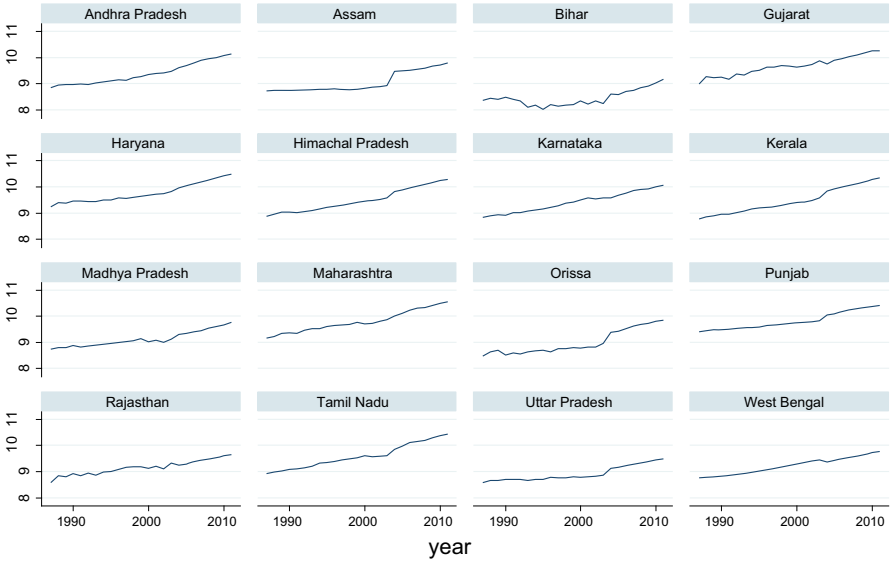
	(b) fixed	(B) random	(b − B) Difference	sqrt(diag(V_b − V_B)) S.E.
lnpcsgdp	0.31726	0.41356	−0.09630	0.02778
lnpcfc	0.15255	0.11304	0.03951	0.01052
lnppi	0.19087	0.35580	−0.16493	0.03143
lnimr	0.33459	0.17542	0.15917	0.03316
lnpd	0.63180	0.00066	0.63114	0.11655
spd	0.02081	0.02510	−0.00429	0.00142

Hausman test result: $chi^2(6) = (b - B)'[(V\_b - V\_B)^{\wedge}(-1)](b - B) = 36.29$ Prob > $chi^2 = 0.0000$
Test: Ho: difference in coefficients not systematic
b = Consistent under Ho and Ha
B = Inconsistent under Ha, efficient under Ho

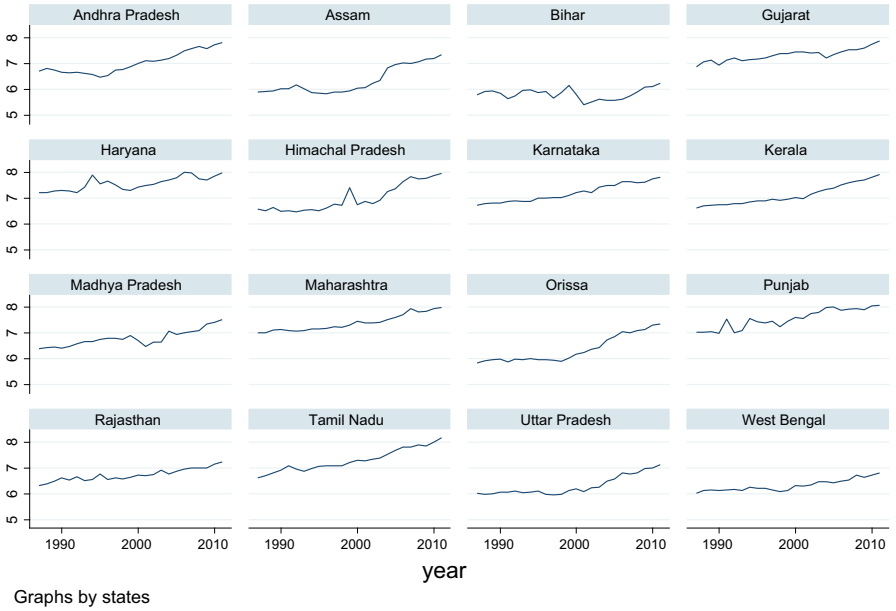
Appendix 3: Trends in Public Expenditure on Health Across States of India



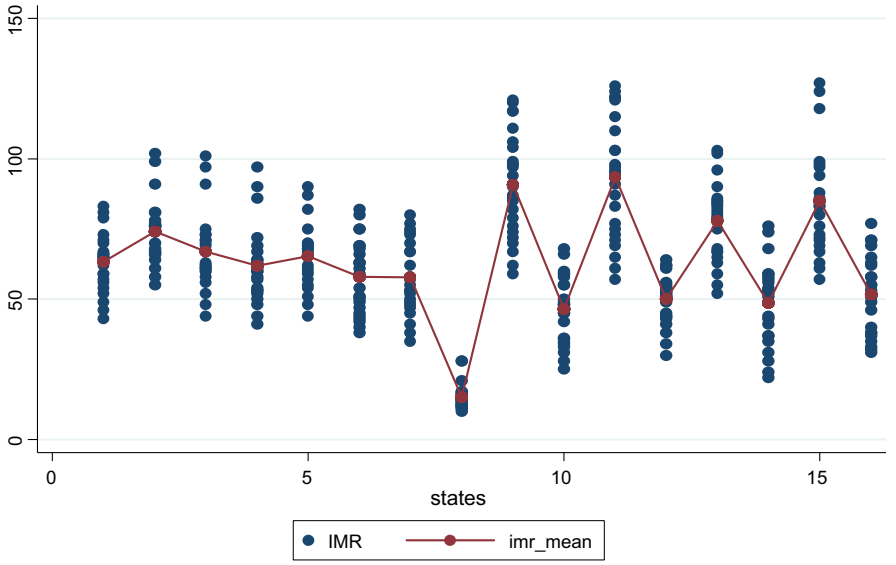
Appendix 4: Trends in GDP Across States of India



Appendix 5: Trends in Fiscal Capacity of States in India



Appendix 6: Variation in IMR Across States of India



References

Akin, J.P., P. Hutchinson, and K. Strumpf. 2001. *Decentralized and government provision of public goods: The public health sector in Uganda* (Working paper WP-01-35). MEASURE evaluation: Carolina Population Center, University of North Carolina and Chapel Hill. http://www.cpc.unc.edu/measure/publications/pdf/wp-01-35.pdf.

Baker, L.C., and S.K. Wheeler. 2000. Managed care and technology diffusion the case of MRI. *Health Affairs* 17: 195–207.

Baltagi, B.H. 2013. *Econometric analysis of panel data*, 5th ed. UK: Wiley.

Baltagi, B.H., and F. Moscone. 2010. Health care expenditure and income in the OECD reconsidered: Evidence from panel data. *Economic Modelling* 27(4): 804–811.

Barros, P. 1998. The black box of health care expenditure growth determinants. *Health Economics* 7: 533–544.

Besley, T., and S. Coate. 1997. An economic model of representative democracy. *Quarterly Journal of Economics* 112(1): 85–114.

Besley, T., R. Pande, and V. Rao. 2005. Participatory democracy in action: Survey evidence from India. *Journal of the European Economics Association* 3(2–3): 648–657.

Bhat, R., and N. Jain. 2004. *Analysis of public expenditure on health using state level data*. Ahmadabad: Indian Institute of Management.

Cameron, C.A., and P.K. Trivedi. 2005. *Microeconometrics: Methods and applications*. Cambridge: Cambridge University Press.

Crepaz, M.M.L. 1998. Inclusion versus exclusion: Political institutions and welfare expenditures. *Comparative Politics* 31(1): 61–80.

Culyer, A.J. 1988. *Health care expenditures in Canada: Myth and reality, past and future*. Toronto: Canadian Tax Foundation.

Di Matteo, L., and R. Di Matteo. 1998. Evidence on the determinants of Canadian provincial government health expenditures: 1965–1991. *Journal of Health Economics* 17(2): 211–228.

Di Matteo, L. 2003. The income elasticity of health care spending: A comparison of parametric and non-parametric approaches. *The European Journal of Health Economics* 4: 20–29.
Dregen, C., and H.E. Reimers. 2005. Health care expenditures in OECD countries: A panel unit root and cointegration analysis. *International Journal of Applied Econometrics and Quantitative Studies* 2: 5–20. IZA Discussion Paper n. 1469.
Durairaj V., and D.B. Evans. 2010. *Fiscal space for health in resource-poor countries. World Health Report-2010*. Background paper no. 41. http://www.who.int/healthsystems/topics/financing/healthreport/41FiscalSpace.pdf.
Erdil, E., and I.H. Yetkiner. 2009. The Granger-causality between health care expenditure and output: A panel data approach. *Applied Economics* 41: 511–518. Taylor & Francis.
Esping-Andersen, G. 1990. *The three words of welfare capitalism*. Princeton: Princeton University Press.
Faguet, J.P. 2004. Does decentralization increase responsiveness to local needs? Evidence from Bolivia. *Journal of Public Economics* 88: 867–894.
Farag, M., et al. 2009. Does funding from donors displace government spending for health in developing countries? *Health Affairs* 28(4): 1045.
Gerdtham, U.G., and M. Löthgren. 2002. New panel results on cointegration of international health expenditure and GDP. *Applied Economics* 34(13): 1679–1686.
Gerdtham, U.G., and B. Jönsson. 2000. International comparisons of health expenditure: theory, data and econometric analysis. In *Handbook of Health Economics*, ed. A.J. Culyer, and J.P. Newhouse, 11–53. Amsterdam: Elsevier.
Gerdtham, U.G., et al. 1998. The determinants of health expenditure in the OECD countries: A pooled data analysis. In *Health, the medical profession, and regulation*, ed. P. Zweifel, 113–134. Boston: Kluwer Academic Publishers.
Gerdtham, U.G., J. Sogaard, et al. 1992. An econometric analysis of health care expenditure: A cross-section study of the OECD countries. *Journal of Health Economics* 11(1): 63–84.
Government of India. 2005. *Mission documents of the National Rural Health Mission (NRHM)*. Government of India (GOI). http://mohfw.nic.in/nrhm.html.
Government of India. 2007. *National Health and Family Welfare (NFHS-3): 2005–06*. Government of India (GOI): Ministry of Health and Family Welfare.
Government of India. 2012. *High level expert group report on universal health coverage for India. Planning Commission, Government of India (GOI), New Delhi*. http://planningcommission.nic.in/reports/genrep/rep_uhc2111.pdf.
Government of India. 2013. 14th Finance Commission of India. *Background paper on estimating true fiscal capacity of states and devising a suitable rule for granting debt relief based on optimal growth requirement, Government of India (GOI)*. http://fincomindia.nic.in/writereaddata%5Chtml_en_files%5Cfincom14/others/32.pdf.
Greene, W.H. 2008. *Econometric analysis, fifth ed., Pearson Education*. New Delhi: Dorling Kindersley Pvt. Ltd.
Gronbjerg, K. 1977. *Mass society and the extension of welfare, 1960–1970*. Chicago: University of Chicago Press.
Hartwig, J. 2008. What drives health care expenditure? Baumol's model of unbalanced growth revisited. *Journal of Health Economics* 27(3): 603–623.
Hitiris, T., and J. Posnett. 1992. The determinants and effects of health expenditure in developed countries. *Journal of Health Economics* 11: 173–181.
Hooda, S.K. 2013. *Changing pattern of public expenditure on health in India: Issues and challenges.* ISID-PHFI Collaborative Research Programme, working paper series, no.wp01. http://isidev.nic.in/pdf/WPc01.pdf.
Kundu, A. 1984. *Measurement of urban processes: A study in regionalisation*. Bombay: Popular Prakashan.
Leu, R.R. 1986. *Public and private health services: Complementarities and conflicts*. Oxford: Basil Blackwell (Chapter The public-private mix and international health care cost).
Lu, C., et al. 2010. Public financing of health in developing countries: A cross-national systematic analysis. *The Lancet* 375(9723): 1375–1387.
Murthy, V., and A. Okunade. 2009. The core determinants of health expenditure in the African context: Some econometric evidence for policy. *Health Policy* 91(1): 57–62.
Newhouse, J.P. 1977. Medical-care expenditure: A cross-national survey. *The Journal of Human Resources* 12(1): 115–125.
Oates, W. 1977. *The political economy of Fiscal Federalism*. Massachusetts: Lexington Books.

Okunade, A.A., and M.C. Karakus. 2001. Unit root and cointegration tests: Time-series versus panel estimates for international health expenditure models. *Applied Economics* 33(9): 1131–1137.

Roberts, J. 1999. Sensitivity of elasticity estimates for OECD health care spending: Analysis of a dynamic heterogeneous data field. *Health Economics* 8(5): 459–472.

Sen, A. 2005. Is health care a luxury? New evidence from OECD data. *International Journal of Health Care Finance and Economics* 5(2 June): 147–164.

van der Gaag, J., and V. Stimac. 2008. *Towards a new paradigm for health sector development*. Amsterdam: Amsterdam Institute for International Development.

Vatter, A., and C. Ruefli. 2003. Do political factor matter for health expenditure: A comparative study of Swiss Cantons. *Journal of Public Policy* 23(3 (sep–Dec)): 301–323.

Wagstaff, A., and World Bank. 2009. *Social health insurance vs. tax-financed health systems: Evidence from the OECD, World Bank*.

Weil, T.P. 1995. Comparisons of Medical Technology in Canadian, German, and US Hospitals. *Hospital & Health Services Administration* 40: 524–533.

WHO. 2010. *Health system financing: the path to universal coverage*. Geneva: World Health Organisation (WHO) (World Health Report).

WHO. 2011. *Non Communicable Diseases Country Profile 2011*. http://www.who.int/nmh/publications/ncd_profiles2011/en/. Accessed 15 April 2013.

WHO. 2013. *World Health Statistics, 2013 & 2015.* Geneva: World Health Organization.

WHO. 2015. *World health statistics, 2013 & 2015*. Geneva: World Health Organization.

Wilson, R.M. 1999. Medical care expenditures and gdp growth in OECD nations. *American Association of Behavioral and Social Sciences Journal* 2: 159–171.

World Bank. 2009. *World Development Report-2009*. Washington DC: World Bank.

Xu, K., P. Saksena, and A. Holly. 2011. *The determinants of health expenditure: A country-level panel data analysis*. Result for Development Institute, World Health Organization, Working Paper, December 2011.